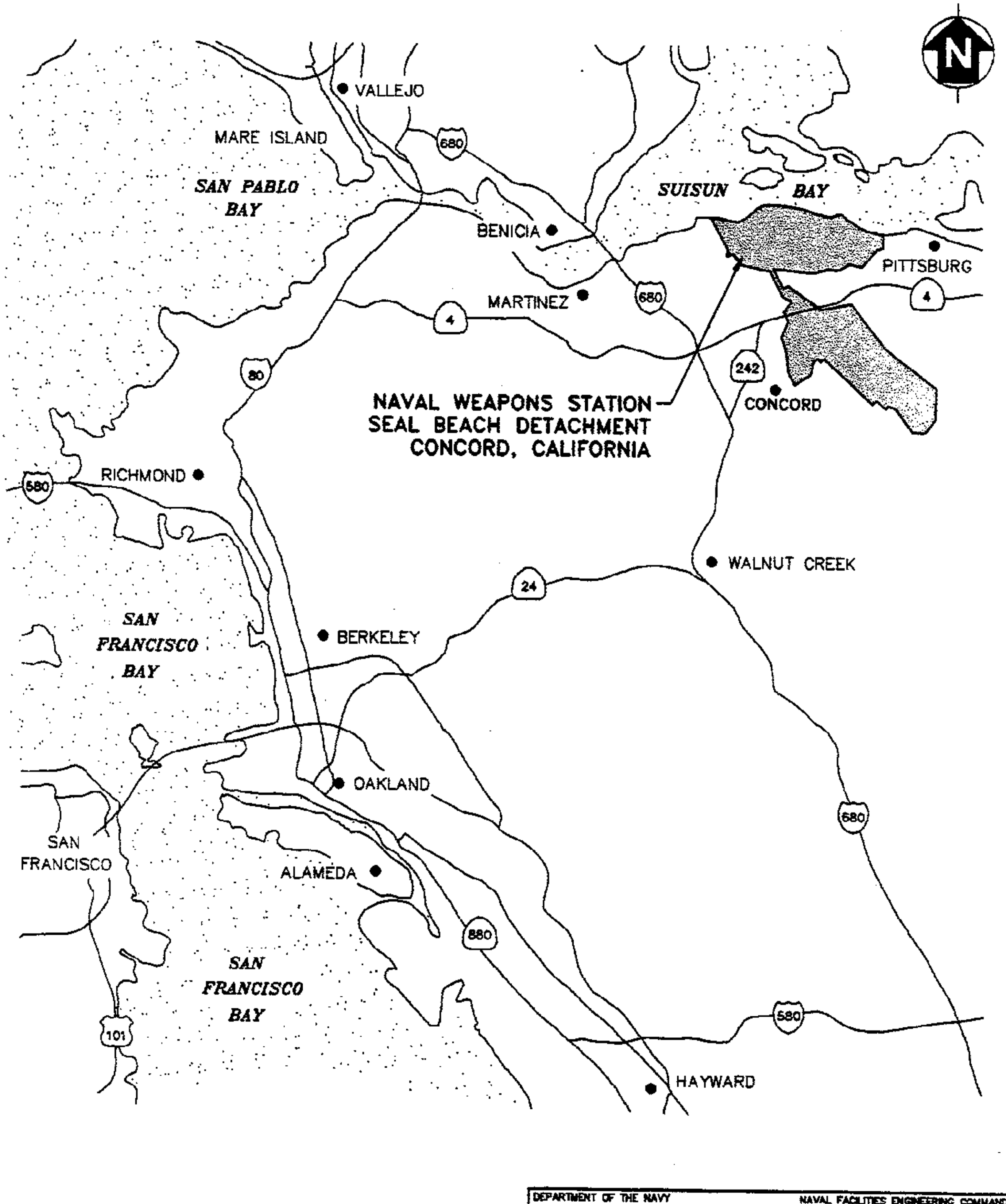
FIGURES



DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

FIGURE 1-1

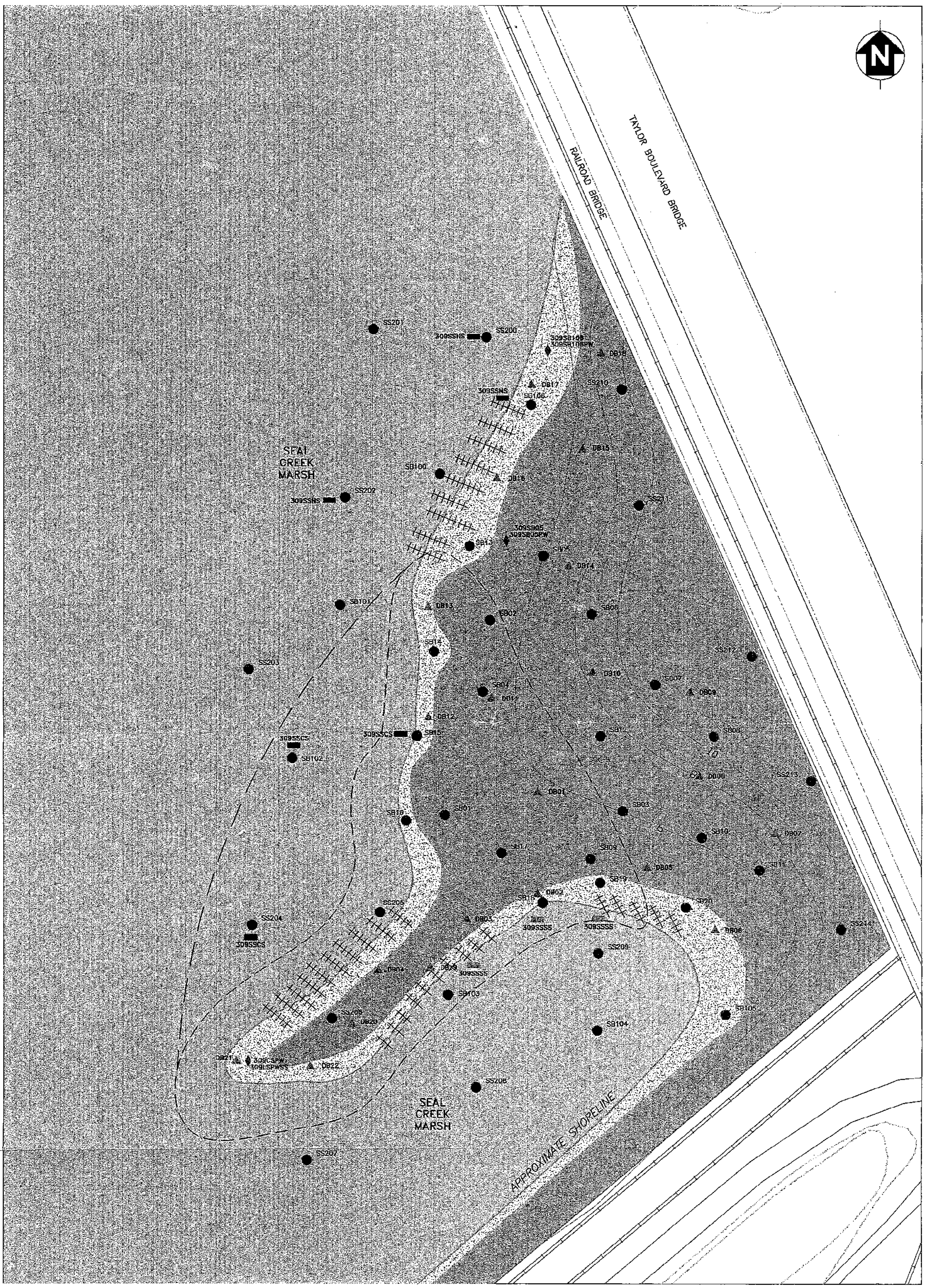
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD SITE VICINITY MAP

KCH (SF) (083-304) CONCLOC.DWG 08/25/00 PLOT 1:1 REV.001

DS.0309.15133

Figure 1-2

This detailed station map has been deleted from the Internet-accessible version of this document as per Department of the Navy Internet security regulations.



LEGEND:

- SS206 SOIL/SEDIMENT SAMPLE (0–0.5 FEET)
- SOIL/SEDIMENT SAMPLE (0–0.5 FEET AND 1.0–2.5 FEET)
- DEBRIS TEST HOLE
- 3 SAMPLES COMPOSITED FOR METALS ANALYSIS AND BIOASSAY
- PICKLEWEED TISSUE, COLLOCATED SEDIMENT ANALYSIS
- AMPHIPOD TISSUE COLLECTION AREA
- APPROXIMATE SHORELINE
- APPROXIMATE EXTENT OF DEBRIS
- SCATTERED SURFACE DEBRIS
- WETLAND/UPLAND TRANSITIONAL HABITAT
- AQUATIC HABITAT
- SEASONAL VARIATION WATER LEVEL
- 6 ELEVATION CONTOURS

20 0 20 40
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

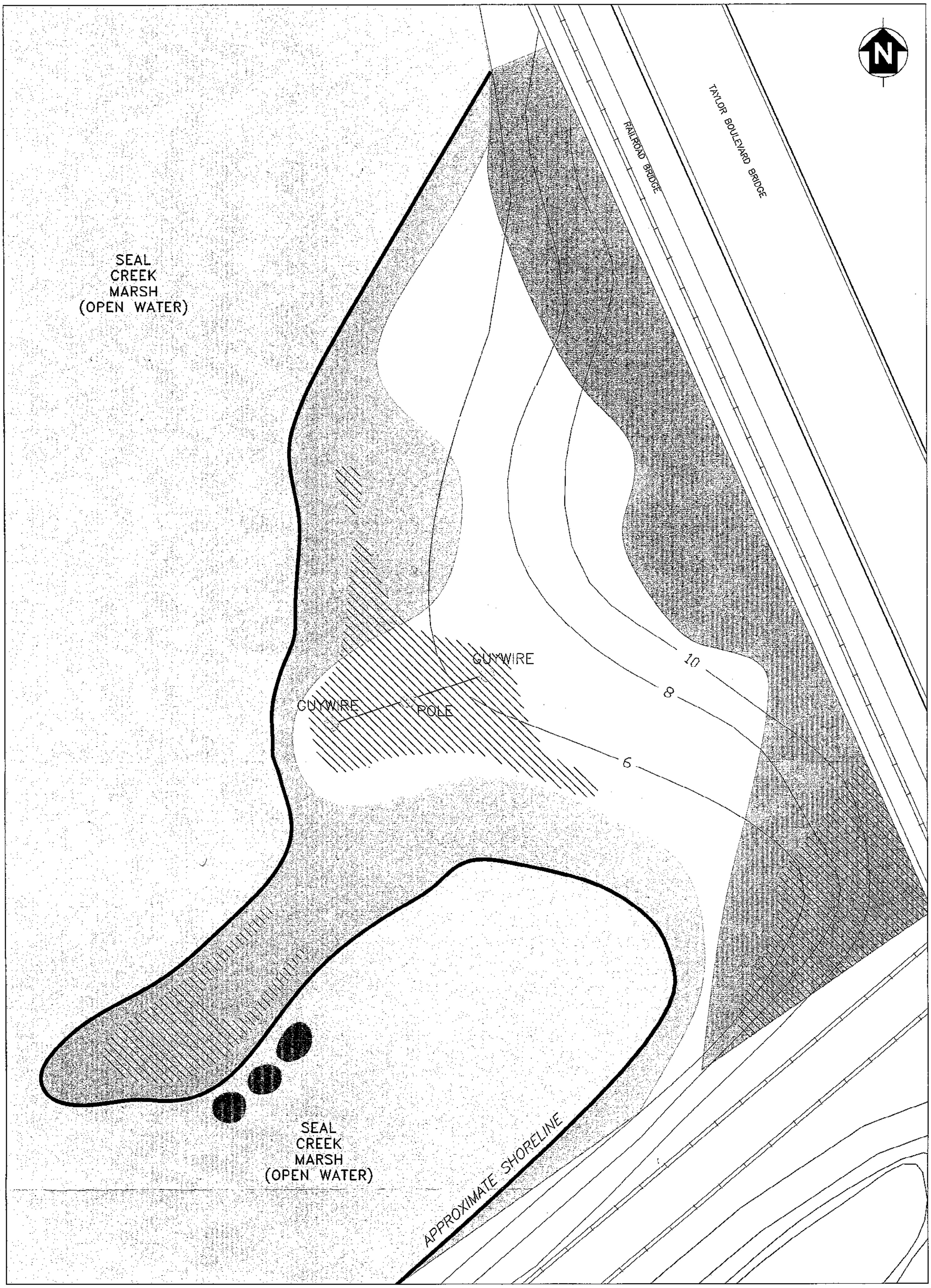
FIGURE 3–1

SAMPLE LOCATION MAP
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

KCH (SF) (089–309) EXTENTDEBRIS.DWG 08/28/00 PLOT VIEW3 LTSCALE.072 REV.001 REMOVED 250 CONTOUR CHECK PSLTSCALE FOR AMPHIPOD TISSUE COLLECTION LINETYPE

DS.0309.15133

R:\Navy\Concord\CT0309\ VTYPEPRESENT.dwg 10/26/2001 marianne.turanek DN



LEGEND:

- WETLAND HABITAT (PICKLEWEED, GUMPLANT)
- WETLAND AND UPLAND TRANSITIONAL HABITAT (ALKALI HEATH, SALT GRASS, UPLAND GRASS, GUMPLANT, ATRIPLEX)
- WETLAND AND UPLAND TRANSITIONAL HABITAT (GUMPLANT, YELLOW STAR THISTLE, ATRIPLEX, ARTICHOKE, FENNEL)
- WETLAND AND UPLAND TRANSITIONAL HABITAT (GUMPLANT)
- AQUATIC HABITAT (CATTAIL)
- AQUATIC HABITAT (SUBMERGED)
- APPROXIMATE SHORELINE
- —6— ELEVATION CONTOURS

15 0 15 30
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

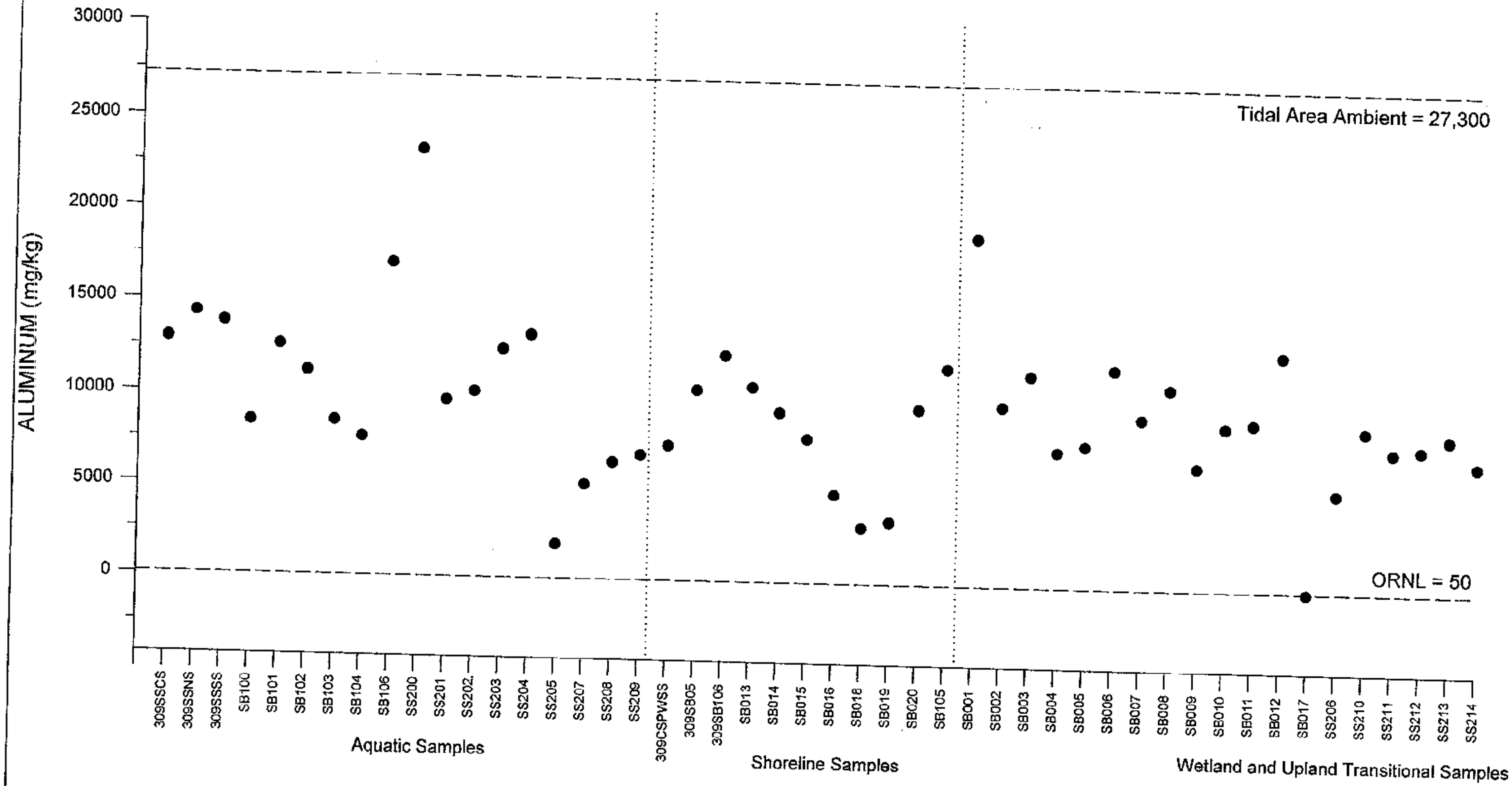
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 3-2
DOMINANT VEGETATION PRESENT
AT
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

DS.0309.15133

CONCENTRATIONS OF ALUMINUM IN SEDIMENT
TAYLOR BOULEVARD BRIDGE, NWSSB DETACHMENT CONCORD



Notes:

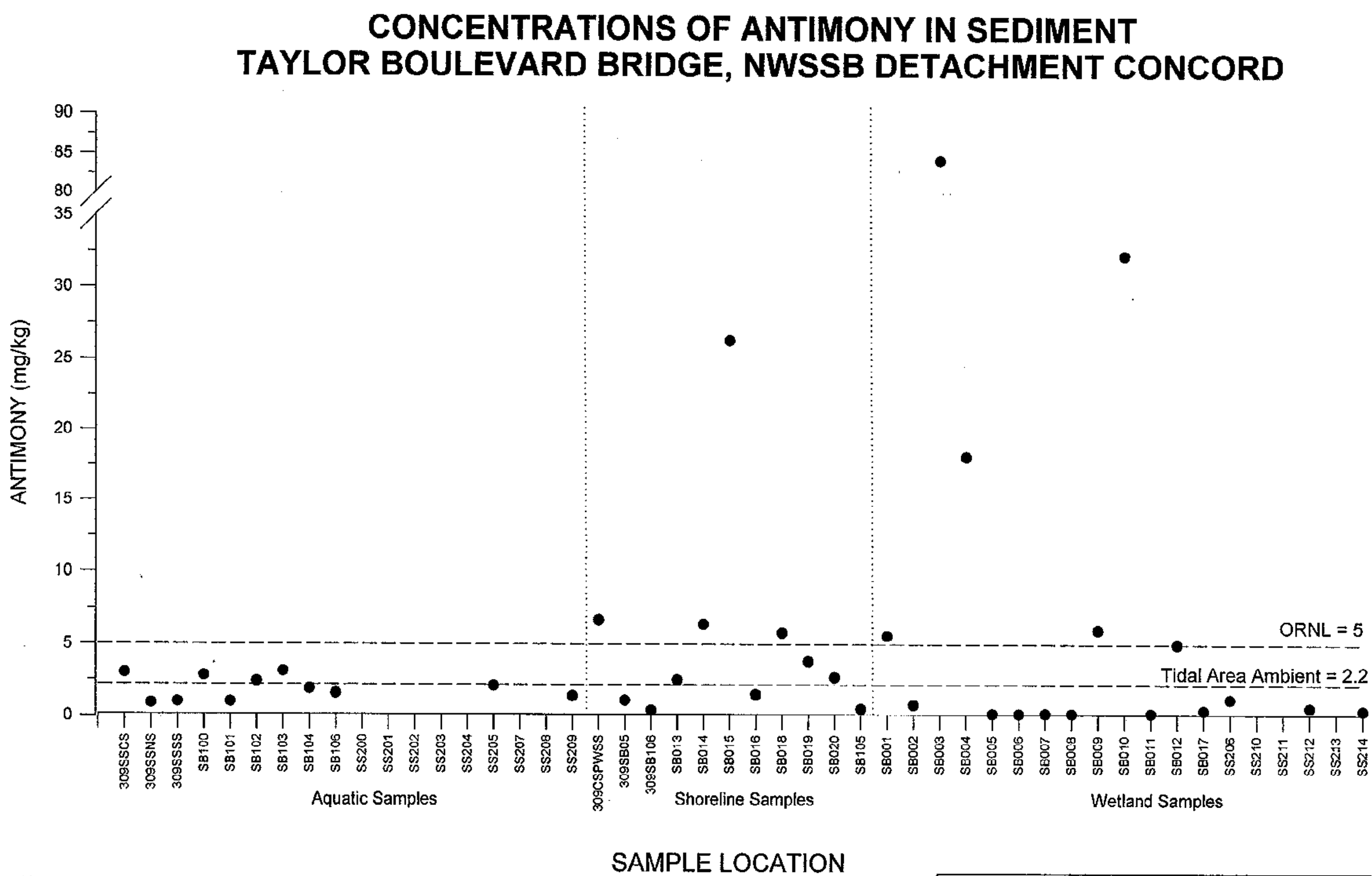
Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge national laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-1
Tetra Tech EM Inc.



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

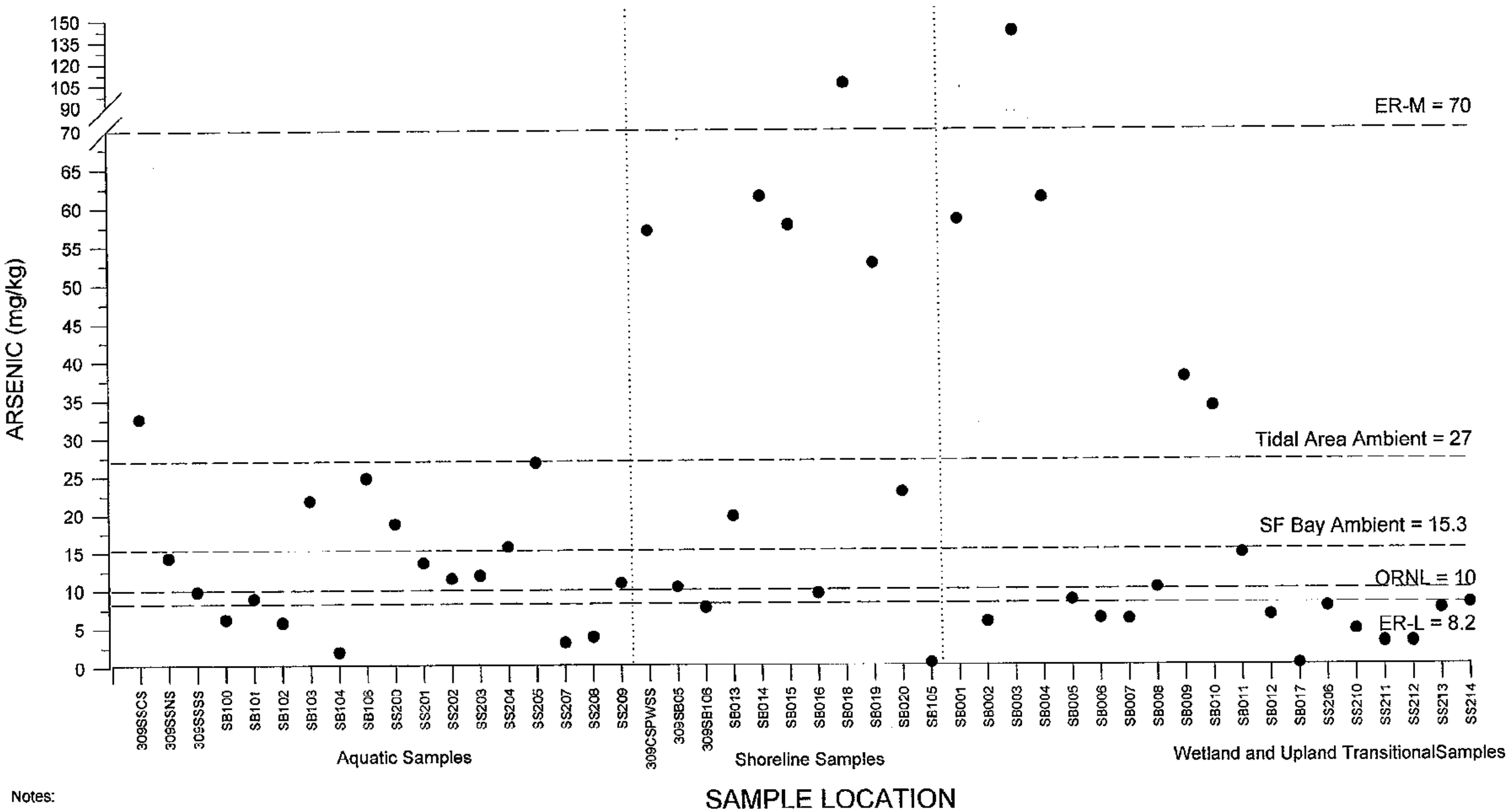
If chemical was not detected, the concentration shown is one half of the detection limi

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-2
Tetra Tech EM Inc.

DS.0309.15133

CONCENTRATIONS OF ARSENIC IN SEDIMENT
TAYLOR BOULEVARD BRIDGE, NWSSB DETACHMENT CONCORD



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May

ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

ER-M, ER-L = Effects range-median, Effects range-low; Long, E.R., D.D. MacDonald, S.L. Smith, F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management. Volume 19. Number 1. Pages 81-97

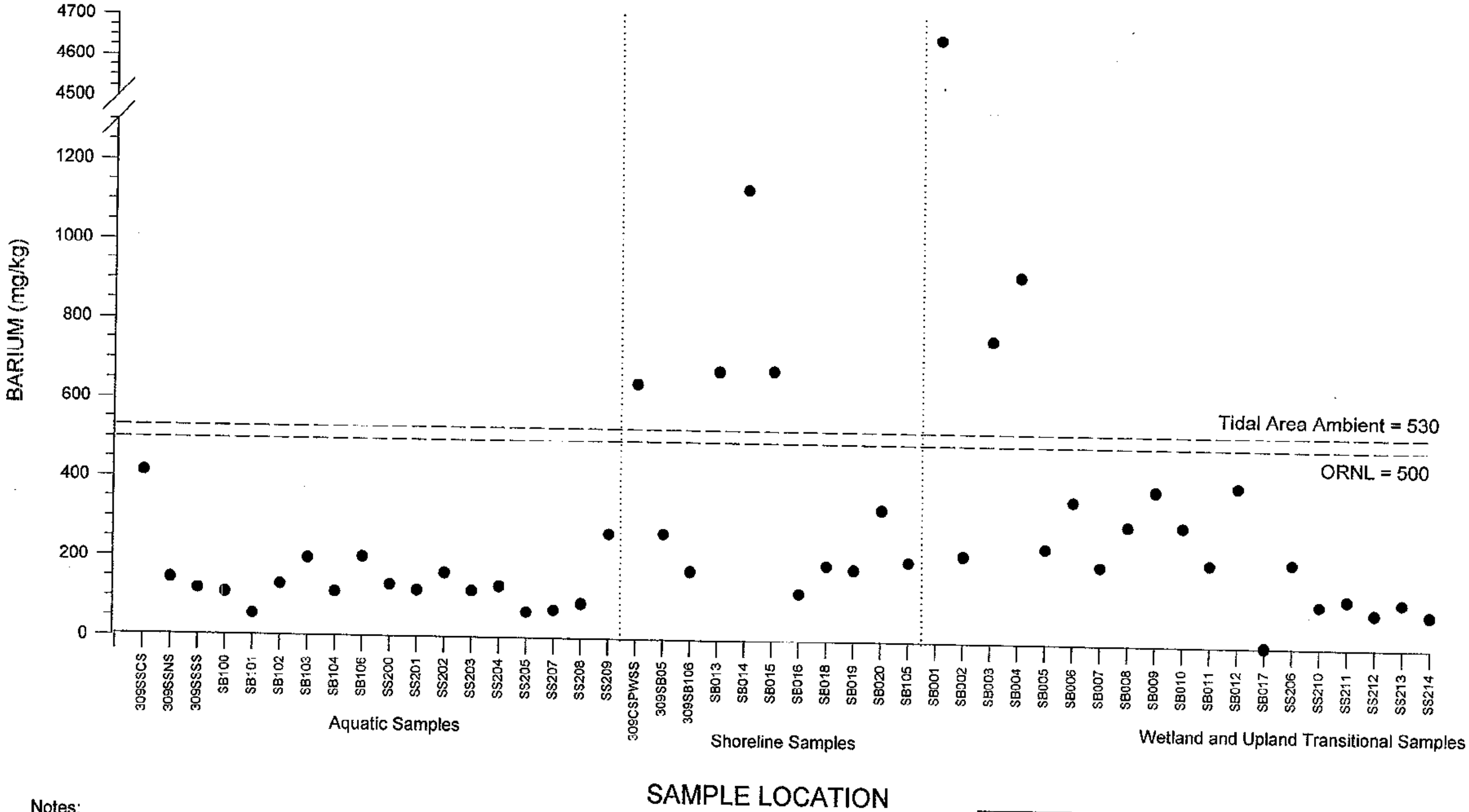
If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-3
Tetra Tech EM Inc.

DS.0309.15133

CONCENTRATIONS OF BARIUM IN SEDIMENT
TAYLOR BOULEVARD BRIDGE, NWSSB DETACHMENT CONCORD



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

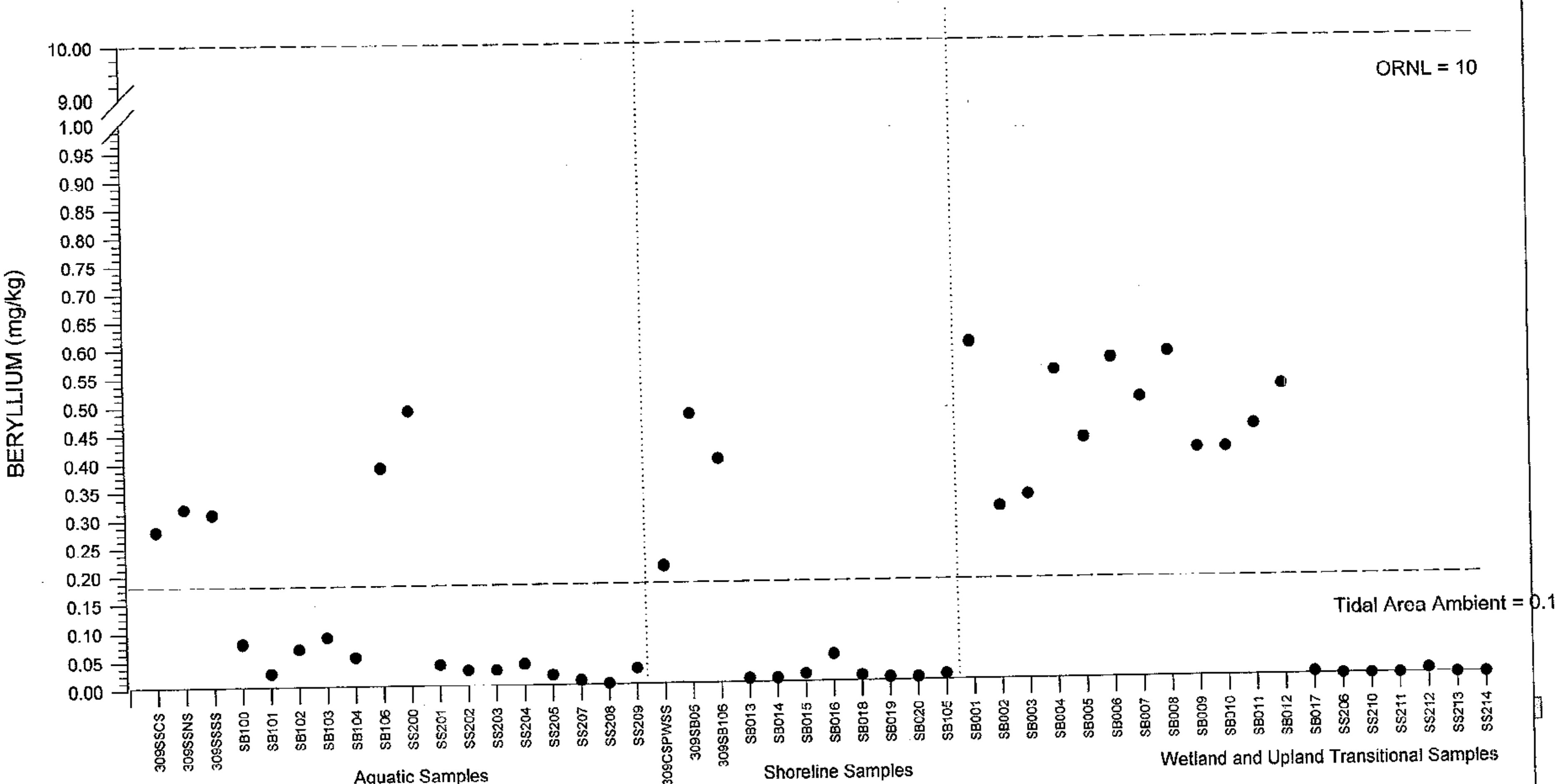
If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-4
Tetra Tech EM Inc.

DS.0309.15133

CONCENTRATIONS OF BERYLLIUM IN SEDIMENT
TAYLOR BOULEVARD BRIDGE, NWSSB DETACHMENT CONCORD



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May

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ER-M, ER-L = Effects range-median, Effects range-low; Long, E.R., D.D. MacDonald, S.L. Smith, F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management. Volume 19. Number 1. Pages 81-97

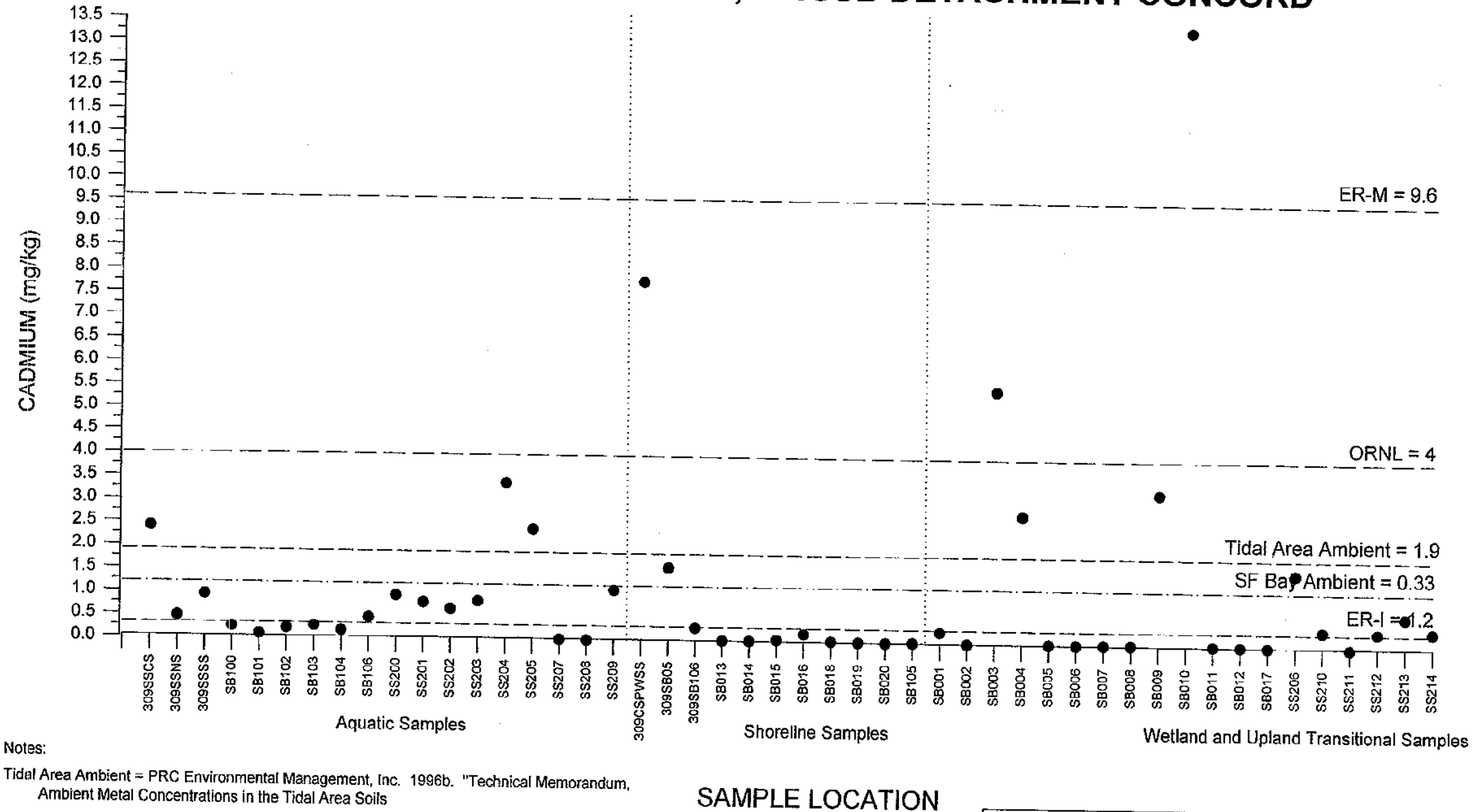
If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-5
Tetra Tech EM Inc.

DS.0309.15133

CONCENTRATIONS OF CADMIUM IN SEDIMENT
TAYLOR BOULEVARD BRIDGE, NWSSB DETACHMENT CONCORD



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May

ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

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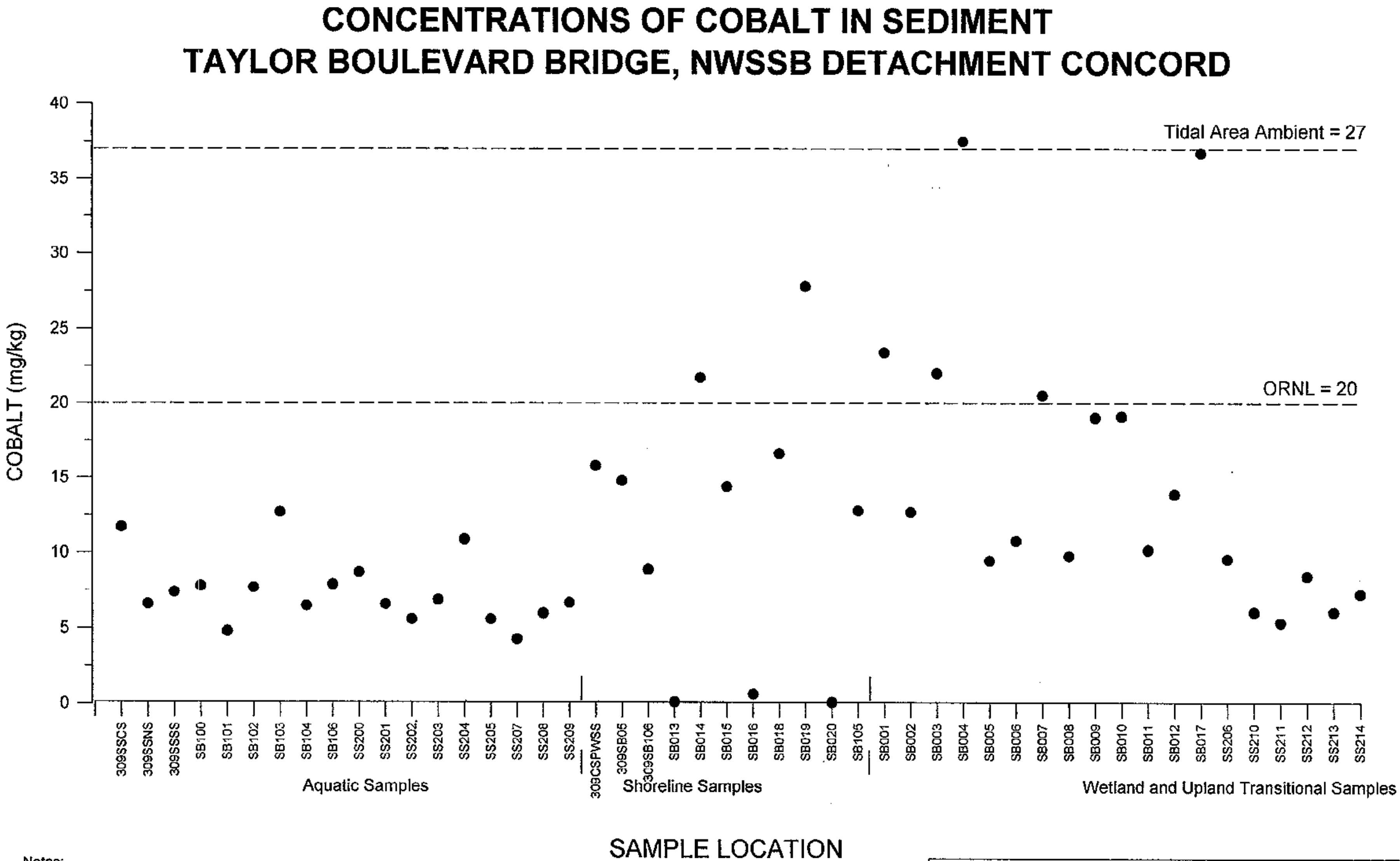
If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-6
Tetra Tech EM Inc.



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

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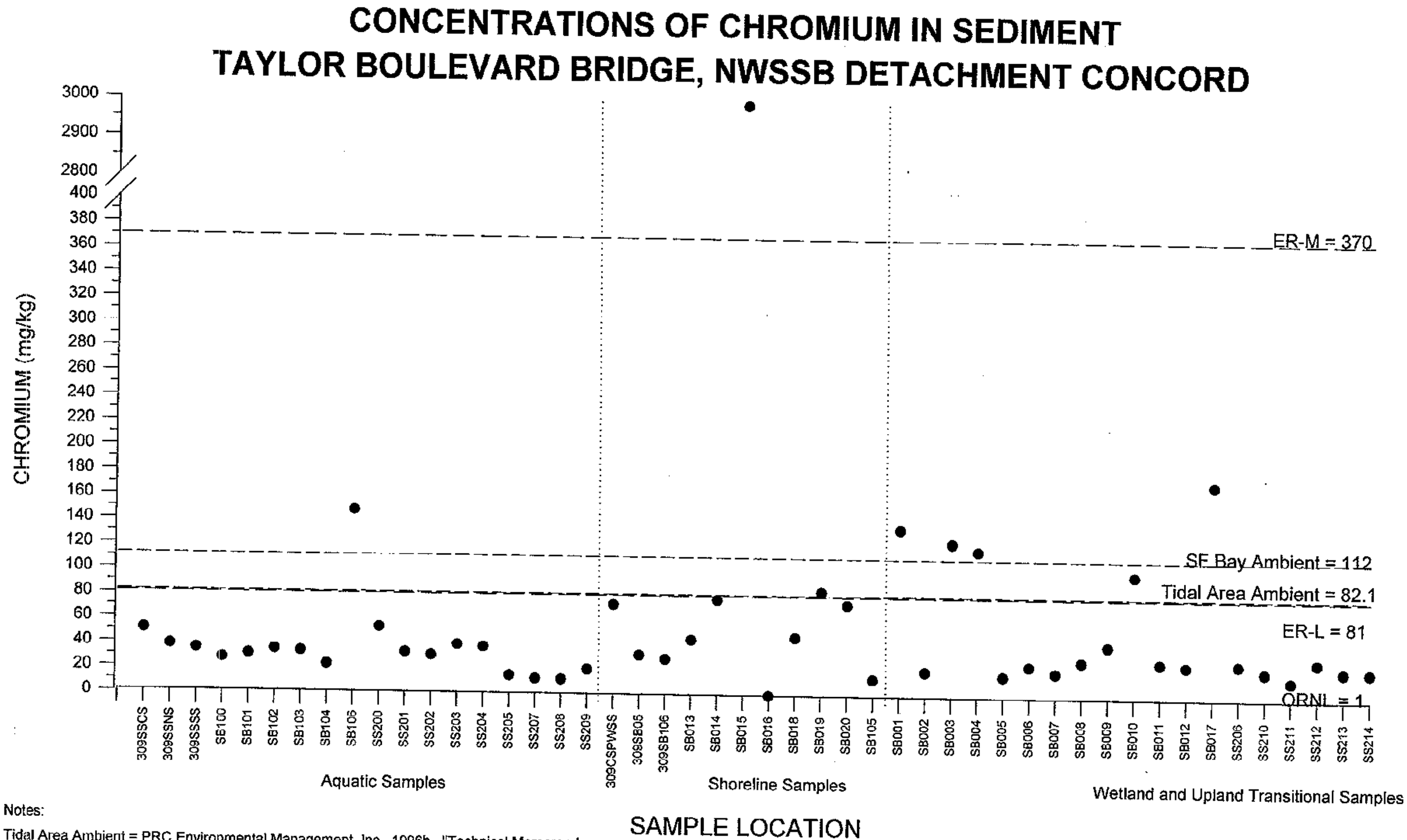
If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-7
Tetra Tech EM Inc.



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May

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If chemical was not detected, the concentration shown is one half of the detection limit

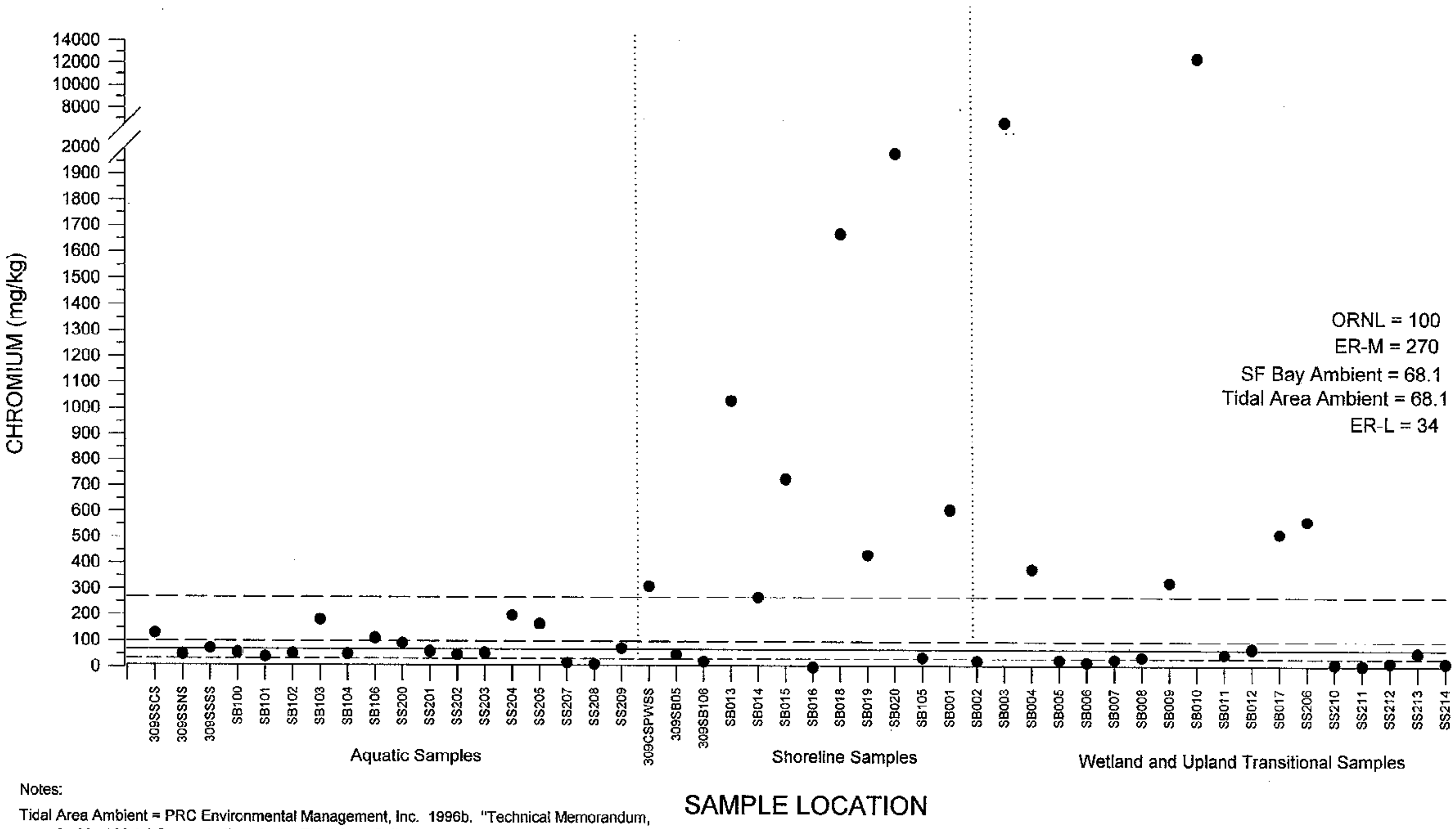
At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD
CONCORD, CALIFORNIA

FIGURE 5-8

Tetra Tech EM Inc.

CONCENTRATIONS OF COPPER IN SEDIMENT
TAYLOR BOULEVARD BRIDGE, NWSSB DETACHMENT CONCORD



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May

ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

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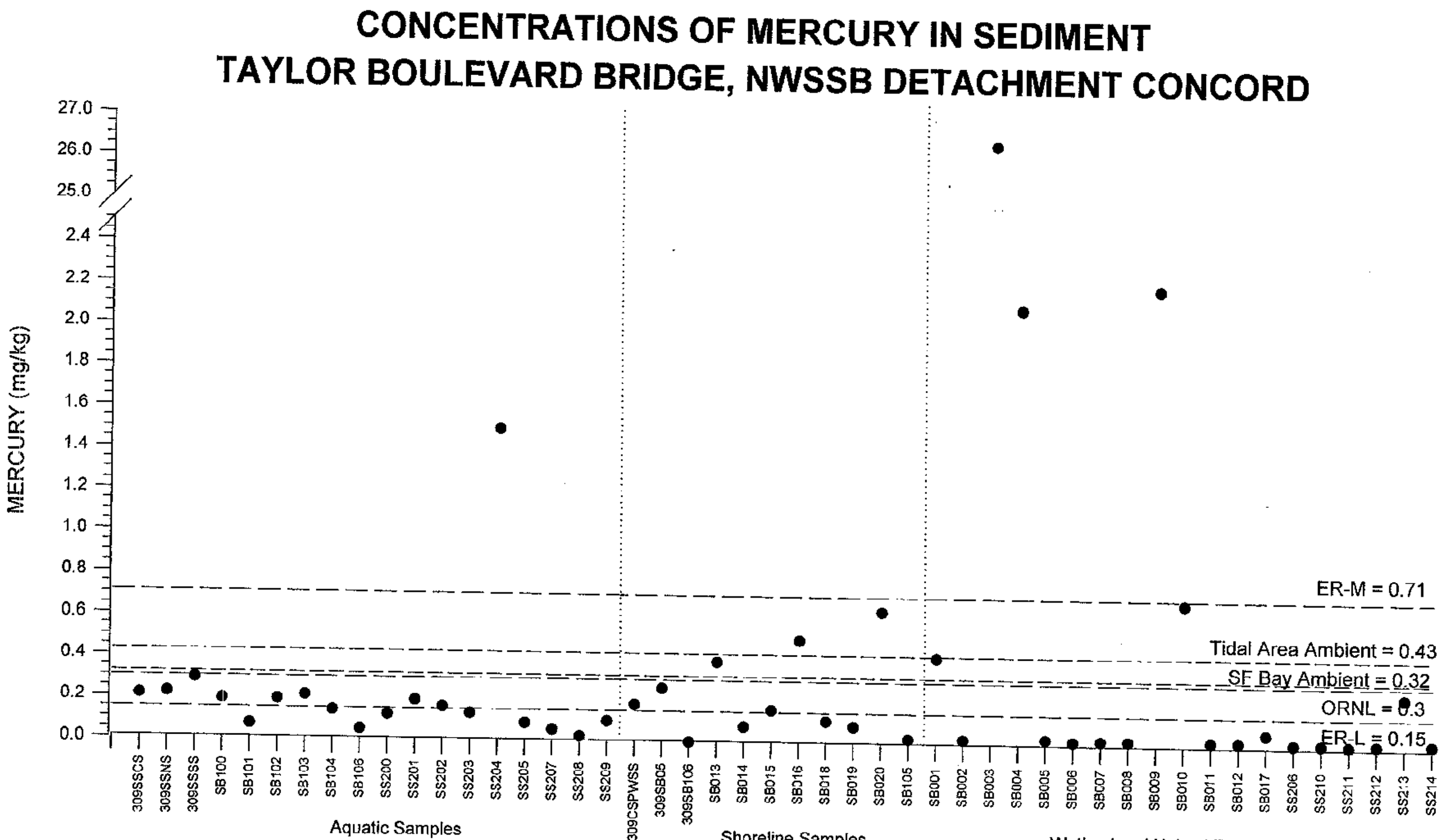
If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-9
Tetra Tech EM Inc.

DS.0309.15133



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May

ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp. ES/ER/TM-85

ER-M, ER-L = Effects range-median, Effects range-low; Long, E.R., D.D. MacDonald, S.L. Smith, F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management. Volume 19. Number 1. Pages 81-97

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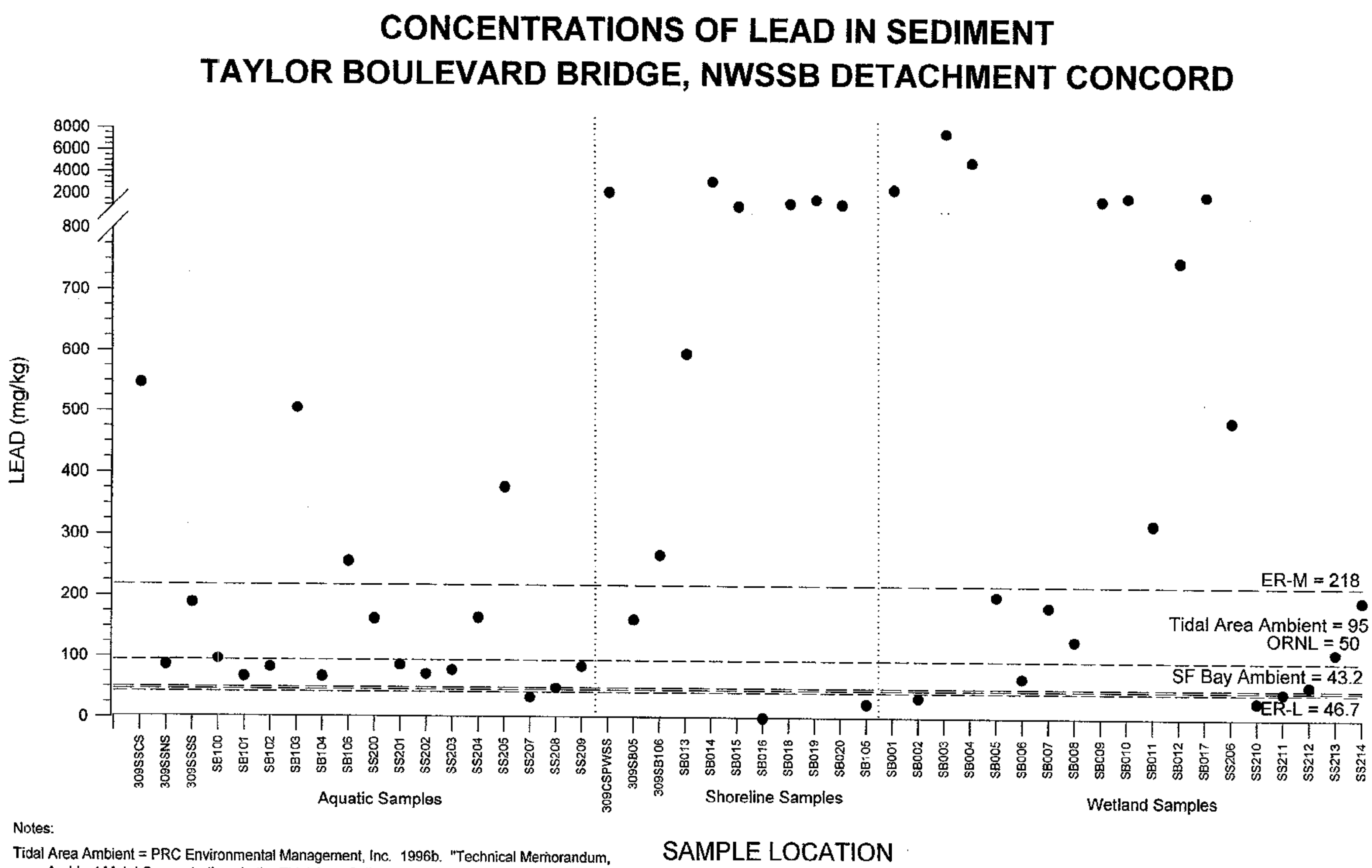
At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-10
Tetra Tech EM Inc.

DS.0309.15133



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May

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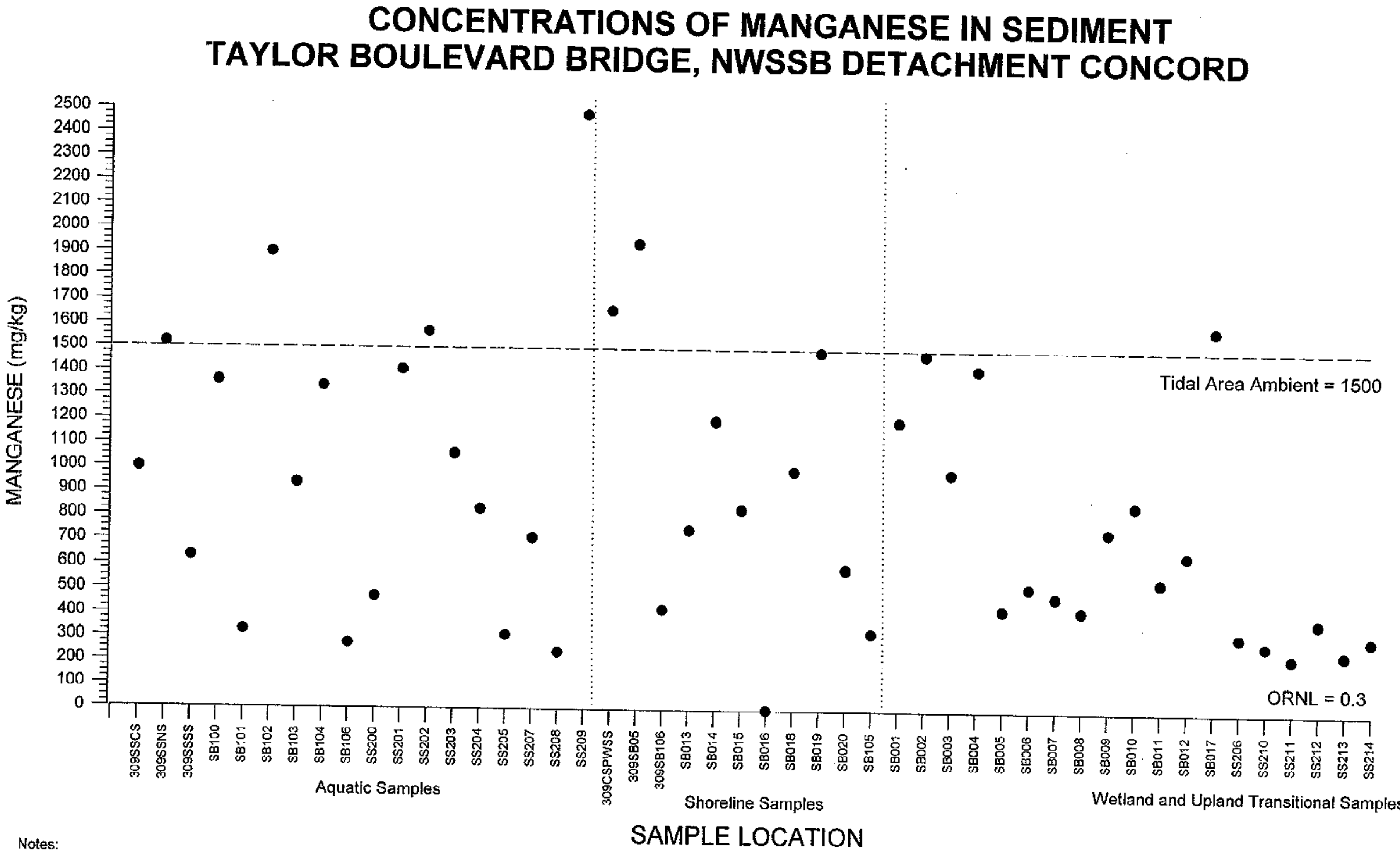
If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-11
Tetra Tech EM Inc.

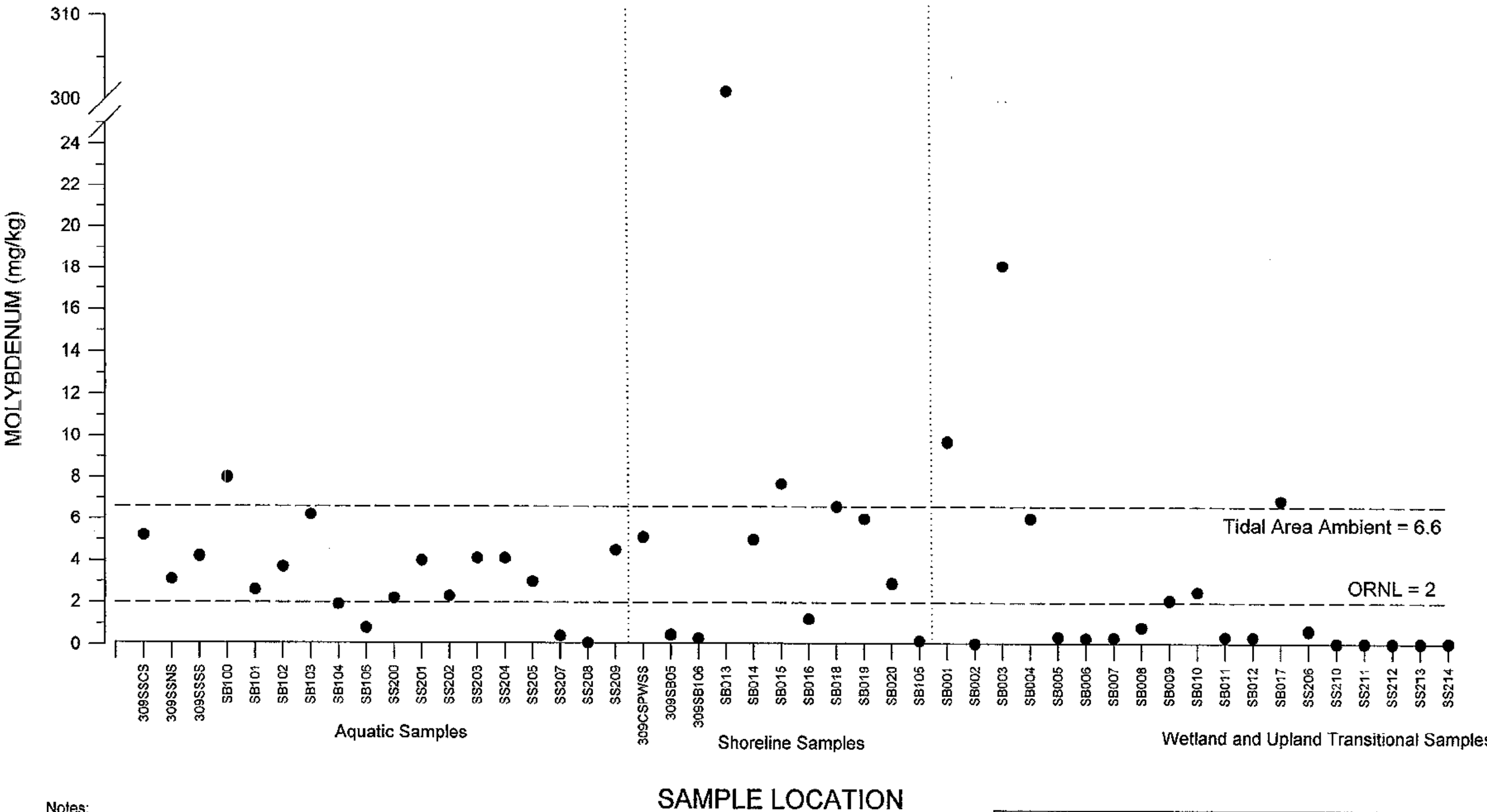
DS.0309.15133



Notes:
SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May
ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. "Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85
ER-M, ER-L = Effects range-median, Effects range-low; Long, E.R., D.D. MacDonald, S.L. Smith, F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management. Volume 19. Number 1. Pages 81-97
If chemical was not detected, the concentration shown is one half of the detection limit
At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-12
Tetra Tech EM Inc.

CONCENTRATIONS OF MOLYBDENUM IN SEDIMENT
TAYLOR BOULEVARD BRIDGE, NWSSB DETACHMENT CONCORD



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

If chemical was not detected, the concentration shown is one half of the detection limit

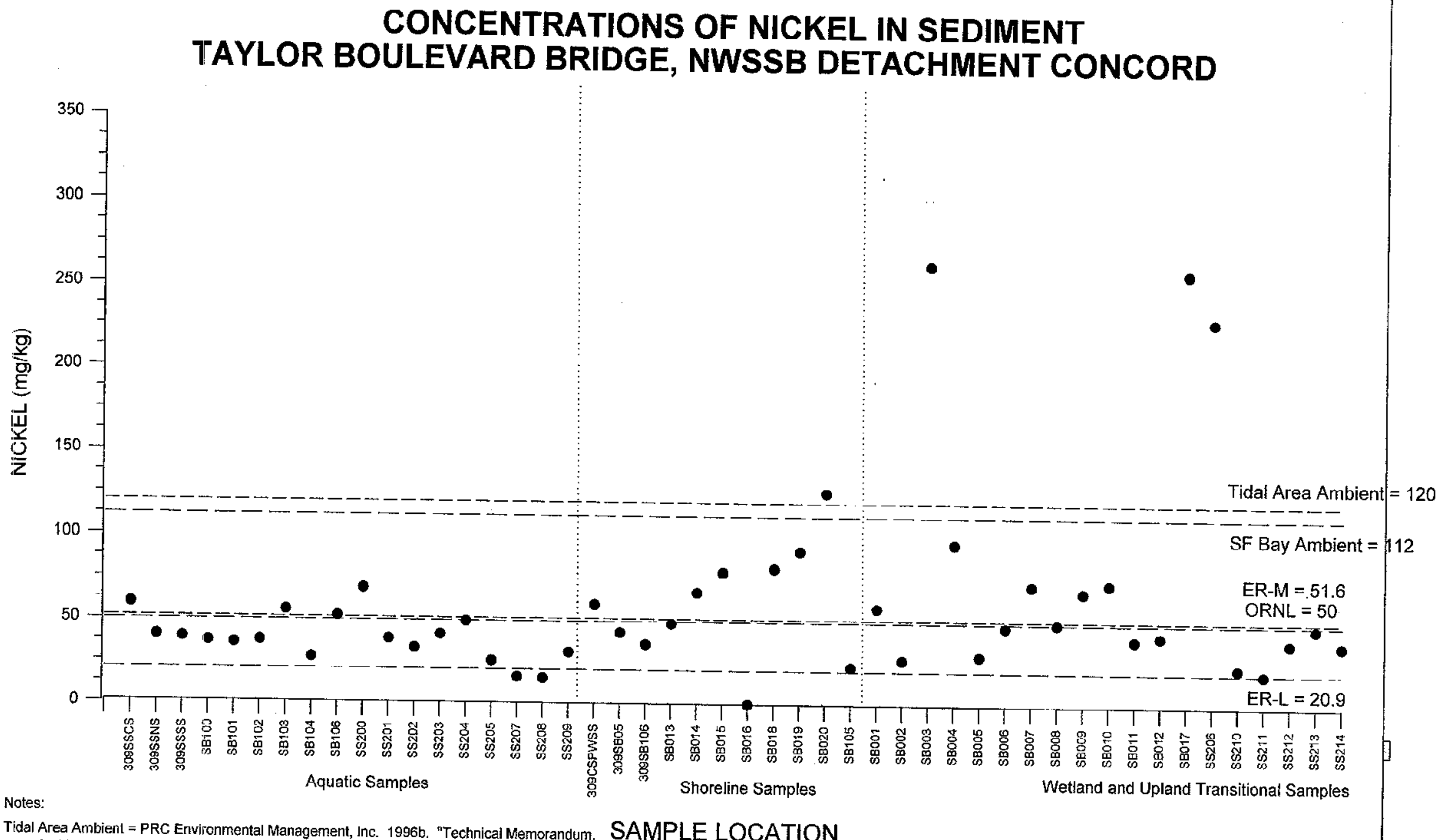
At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD
CONCORD, CALIFORNIA

FIGURE5-14

Tetra Tech EM Inc.

DS.0309.15133



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May

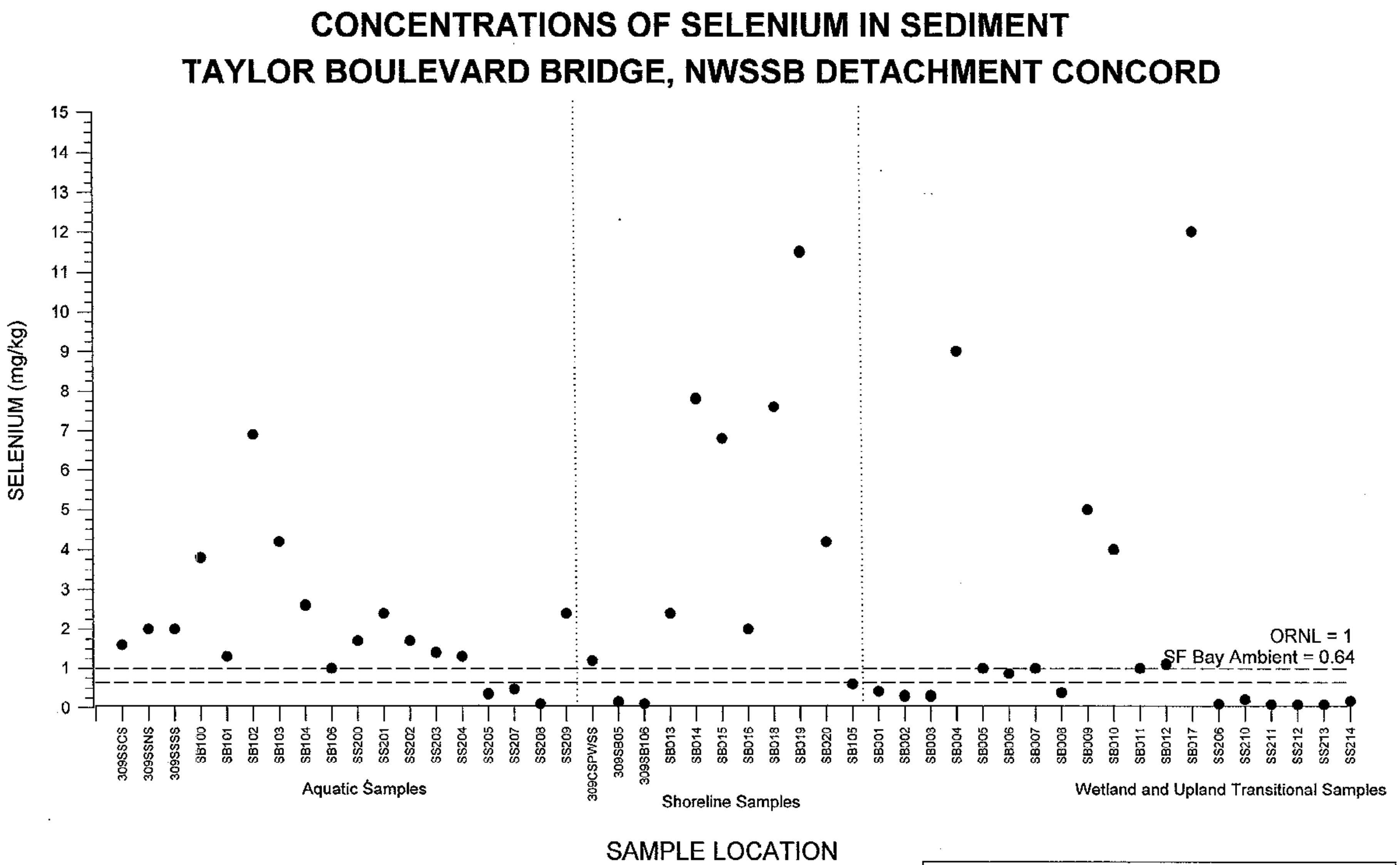
ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. "Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

ER-M, ER-L = Effects range-median, Effects range-low; Long, E.R., D.D. MacDonald, S.L. Smith, F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management. Volume 19. Number 1. Pages 81-97

If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-15
Tetra Tech EM Inc.



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At locations where surface and subsurface samples were collected, maximum concentration is shown

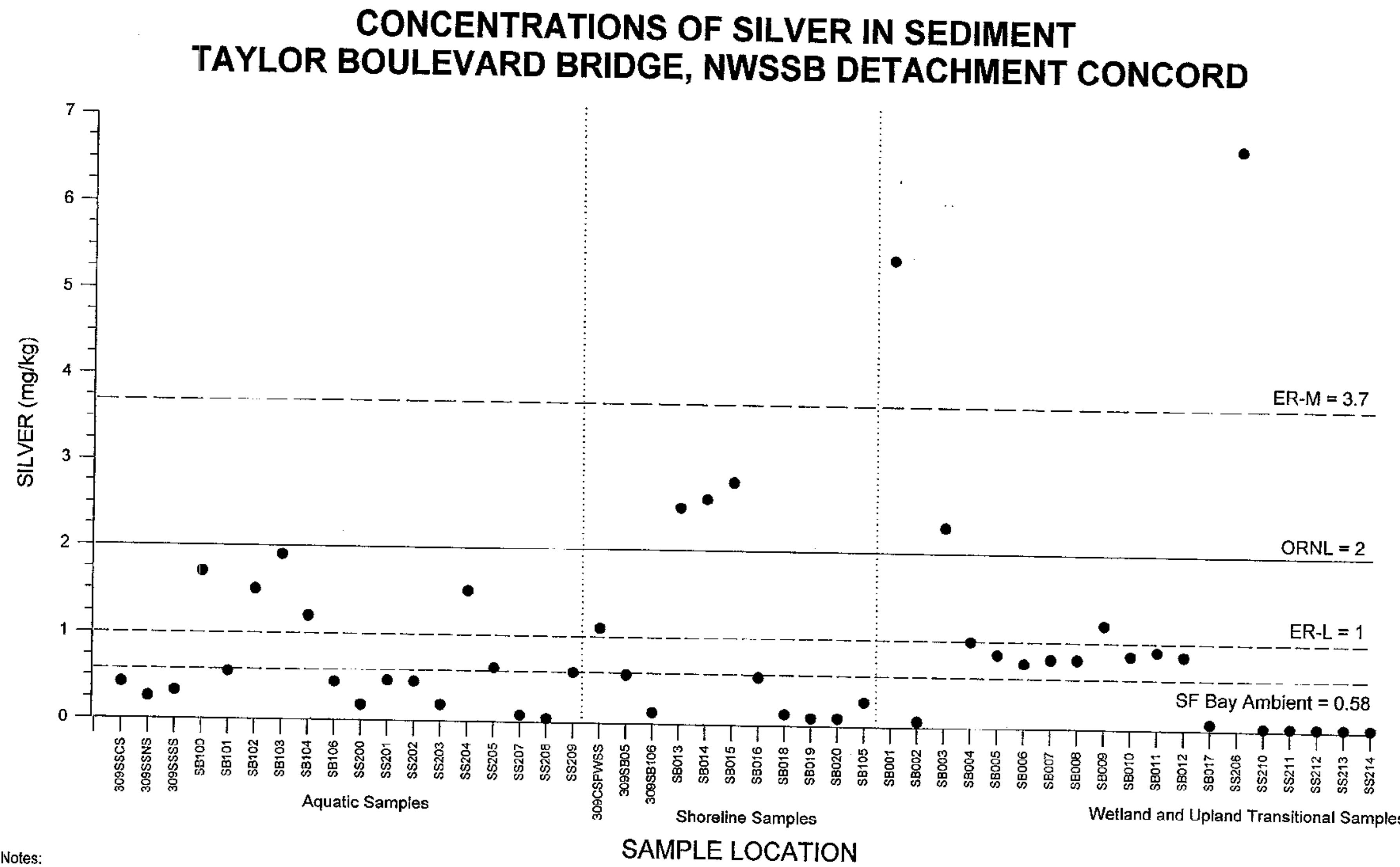
If chemical was not detected, the concentration shown is one half of the detection limit

NWSSB DETACHMENT CONCORD
CONCORD, CALIFORNIA

FIGURE 5-16

Tetra Tech EM Inc.

DS.0309.15133



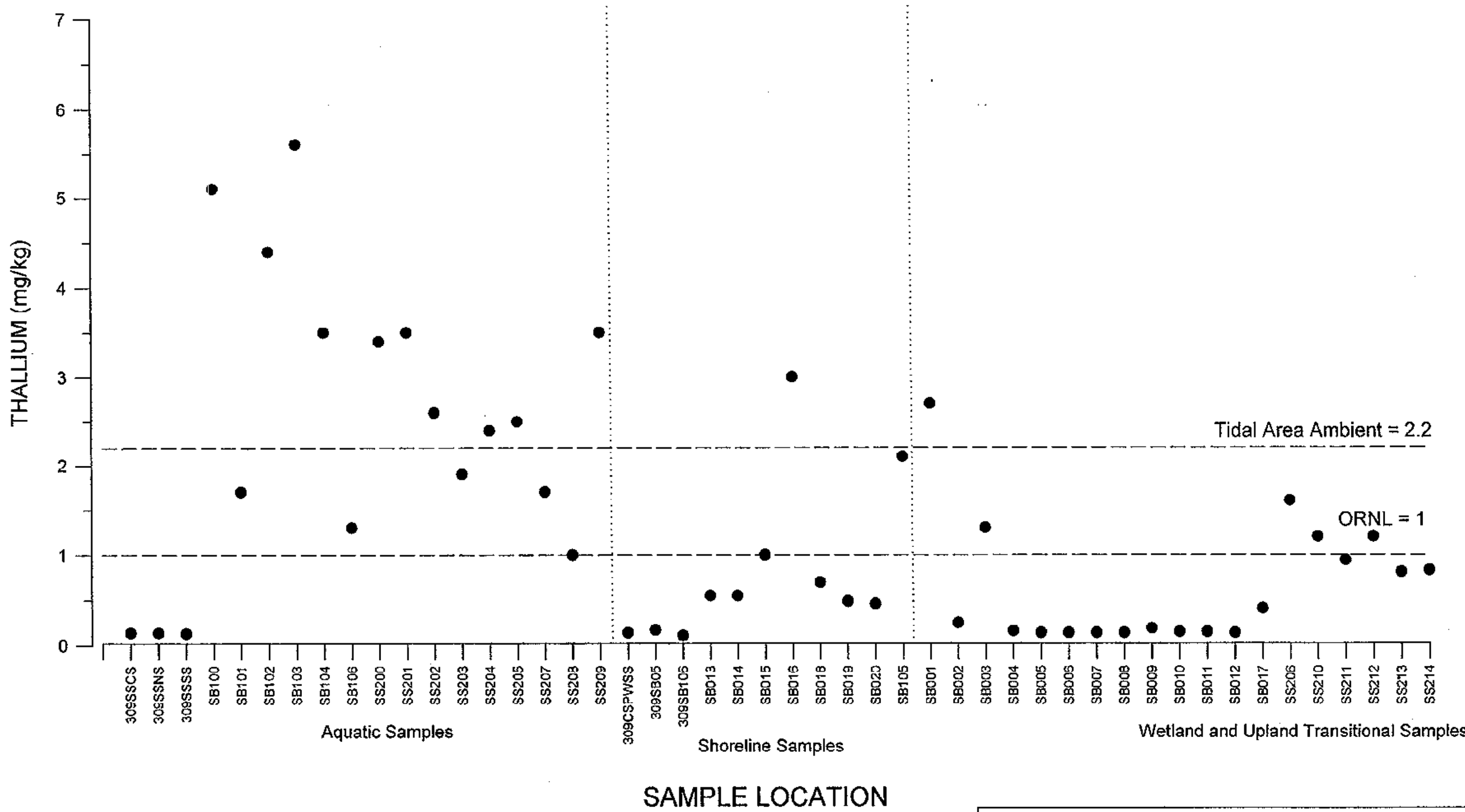
Notes:

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May
ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp. ES/ER/TM-85
ER-M, ER-L = Effects range-median, Effects range-low; Long, E.R., D.D. MacDonald, S.L. Smith, F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management. Volume 19. Number 1. Pages 81-97
If chemical was not detected, the concentration shown is one half of the detection limit
At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-17
Tetra Tech EM Inc.

DS.0309.15133

CONCENTRATIONS OF THALLIUM IN SEDIMENT
TAYLOR BOULEVARD BRIDGE, NWSSB DETACHMENT CONCORD



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

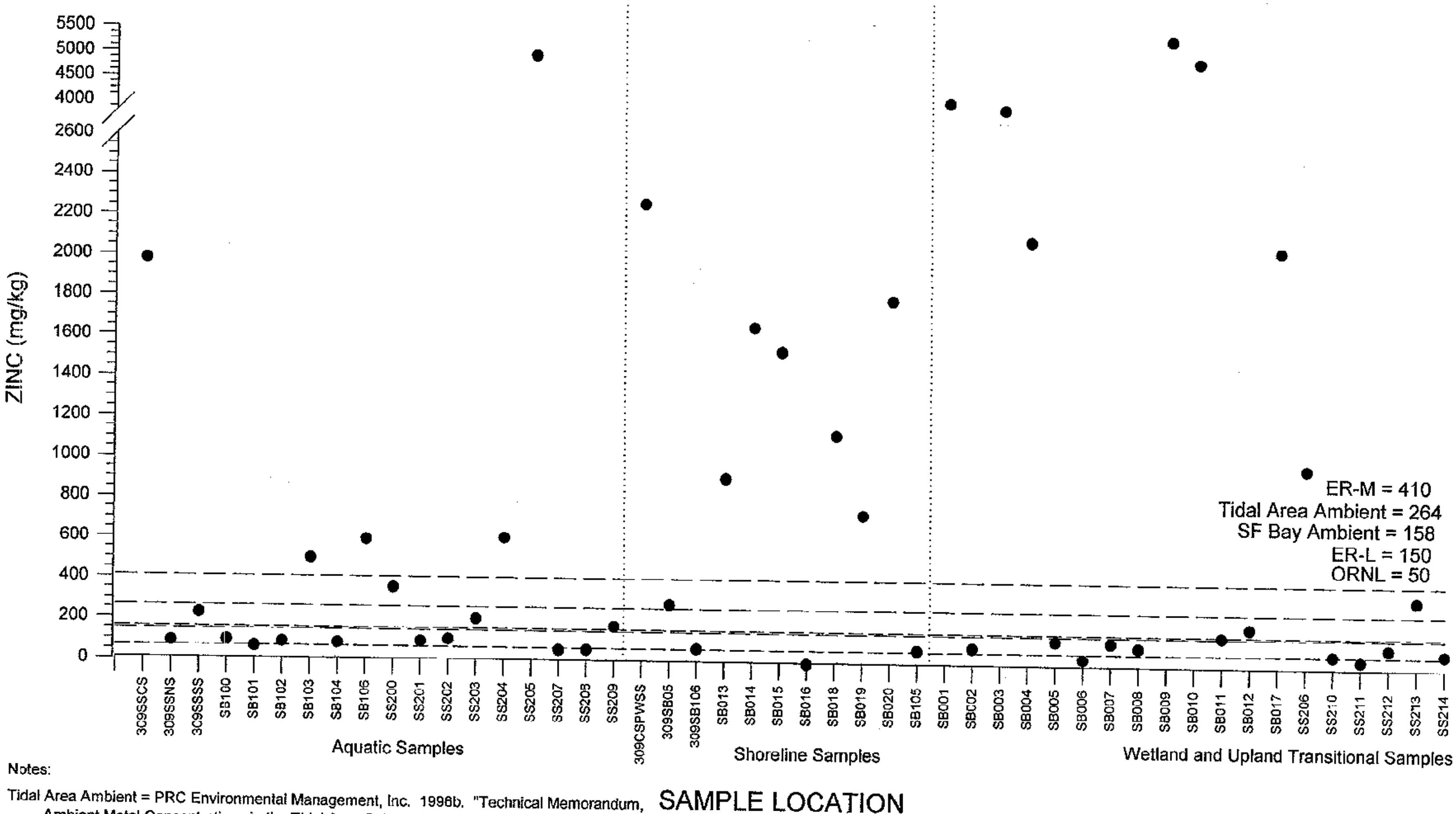
ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-18
Tetra Tech EM Inc.

CONCENTRATIONS OF ZINC IN SEDIMENT
TAYLOR BOULEVARD BRIDGE, NWSSB DETACHMENT CONCORD



Notes:

Tidal Area Ambient = PRC Environmental Management, Inc. 1996b. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils

SF Bay Ambient = RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May

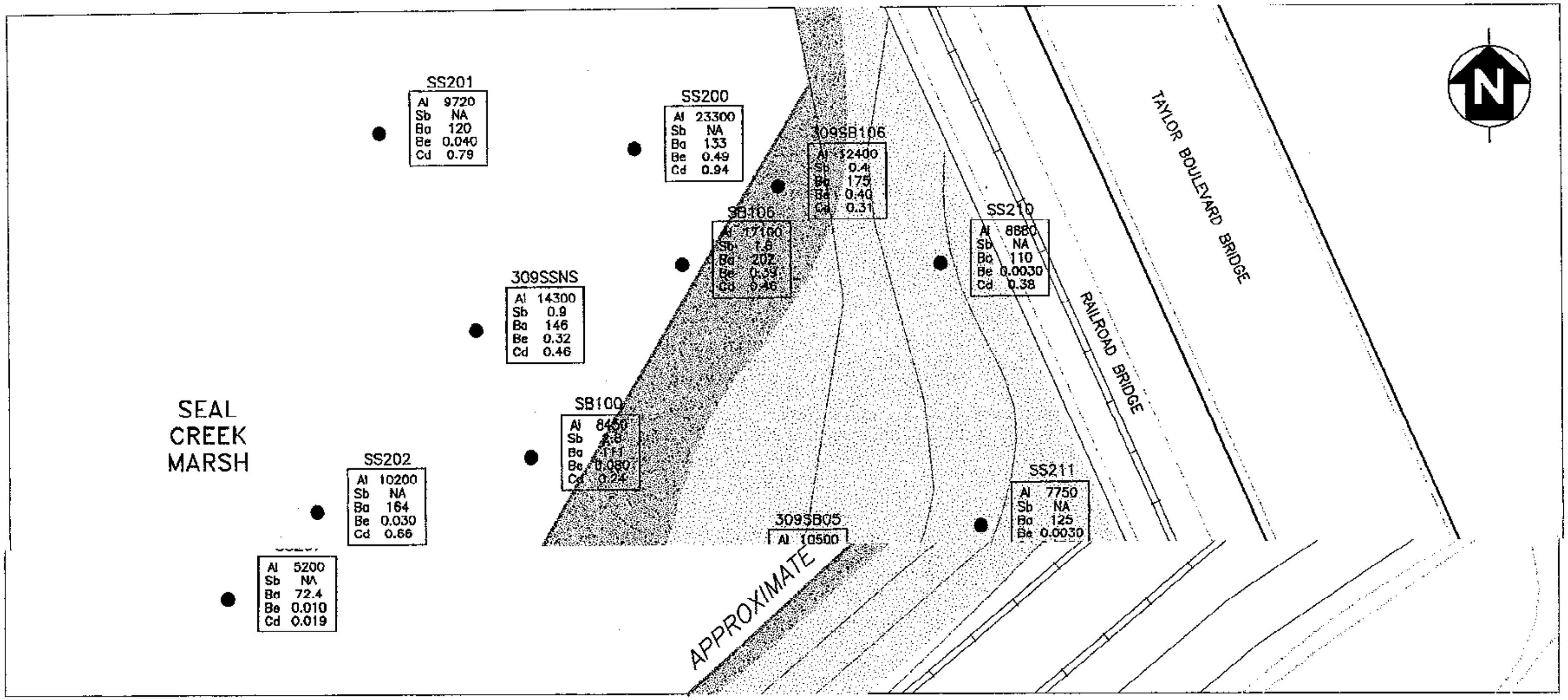
ORNL = Oak Ridge National Laboratory Plant Toxicity Benchmark. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85

ER-M, ER-L = Effects range-median, Effects range-low; Long, E.R., D.D. MacDonald, S.L. Smith, F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management. Volume 19. Number 1. Pages 81-97

If chemical was not detected, the concentration shown is one half of the detection limit

At locations where surface and subsurface samples were collected, maximum concentration is shown

NWSSB DETACHMENT CONCORD CONCORD, CALIFORNIA
FIGURE 5-19
Tetra Tech EM Inc.



LEGEND:

- ● SAMPLE LOCATION
- WETLAND AND UPLAND TRANSITIONAL HABITAT
- AQUATIC HABITAT
- APPROXIMATE SEASONAL WATER LEVEL VARIATION
- APPROXIMATE SHORELINE
- NA — NOT ANALYZED
- mg/kg — MILLIGRAMS PER KILOGRAM
- UCL — UPPER CONFIDENCE LEVEL OF THE MEAN
- —6— ELEVATION CONTOURS

SYMBOL	METAL	CONCORD TIDAL AREA AMBIENT	RWQCB SAN FRANCISCO BAY AMBIENT	WHOLE SITE 95% UCL	AQUATIC HABITAT 95% UCL	WETLAND AND UPLAND TRANSITIONAL 95% UCL
Al	Aluminum	27300	NA	10590	11300	9830
Sb	Antimony	2.2	NA	10.1	5.5	14.7
Ba	Barium	530	NA	508	320	716
Be	Beryllium	0.18	NA	0.24	0.17	0.3
Cd	Cadmium	1.9	0.33	1.7	1.4	2.1

NOTES:

1. ONE-HALF THE DETECTION LIMIT SUBSTITUTED FOR NONDETECTS
2. FOR LOCATIONS WHERE SURFACE AND SUBSURFACE SAMPLES AVAILABLE, MAXIMUM CONCENTRATION USED IN CALCULATION OF UCL

15 0 15 30
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

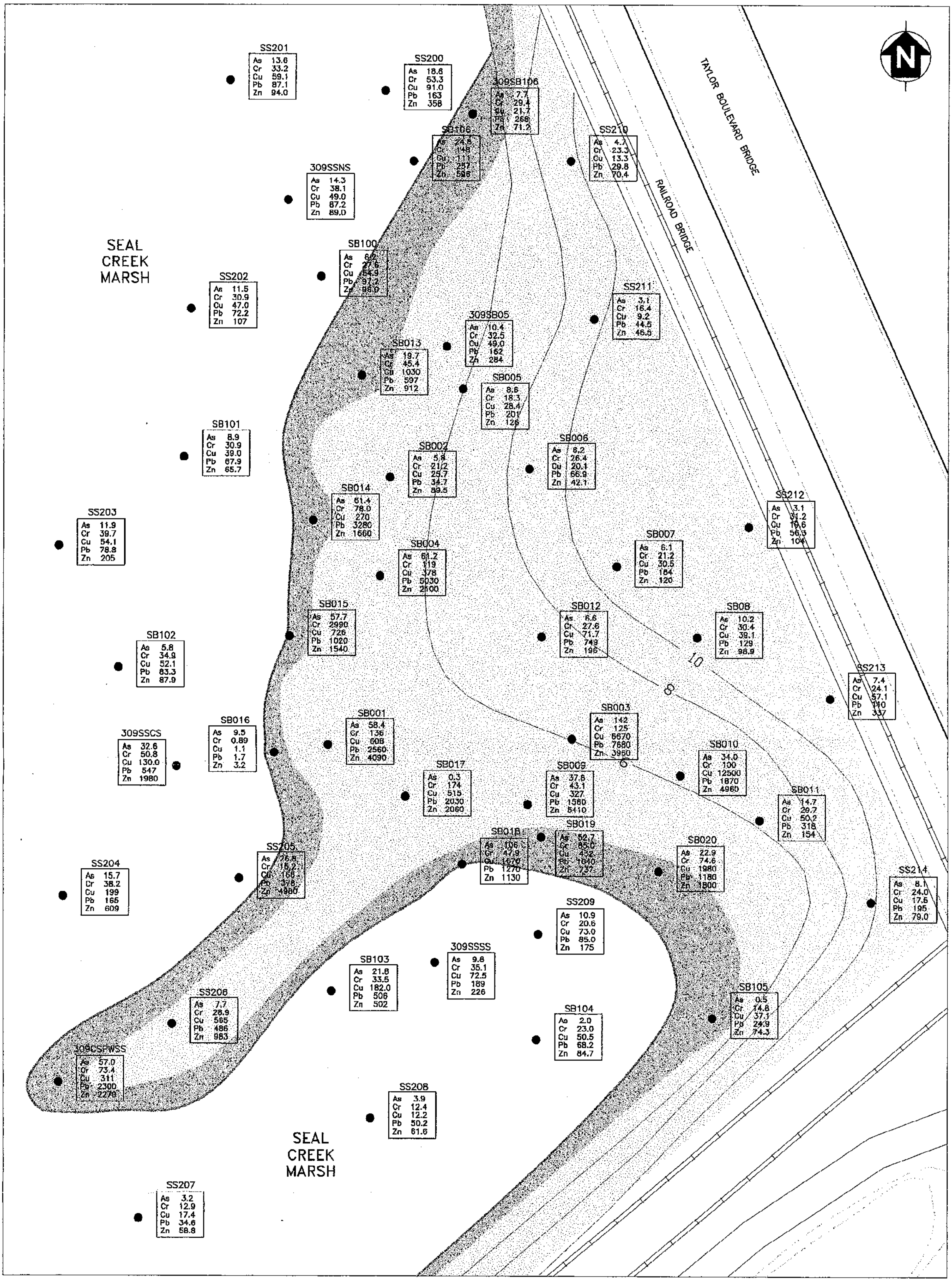
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 5–22
CONCENTRATIONS OF ALUMINUM, ANTIMONY, BARIUM, BERYLLIUM, AND CADMIUM IN SEDIMENT (in mg/kg)
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

CH (SF) (069-309) 51BOXSAMPS.DWG 07/27/00 REV.00

DS.0309.15133



LEGEND:

- ● SAMPLE LOCATION
- —6— ELEVATION CONTOURS
- WETLAND AND UPLAND TRANSITIONAL HABITAT
- AQUATIC HABITAT
- APPROXIMATE SEASONAL WATER LEVEL VARIATION
- APPROXIMATE SHORELINE
- NA NOT ANALYZED
- mg/kg MILLIGRAMS PER KILOGRAM
- UCL UPPER CONFIDENCE LEVEL OF THE MEAN

NOTES:

1. ONE-HALF THE DETECTION LIMIT SUBSTITUTED FOR NONDETECTS
2. FOR LOCATIONS WHERE SURFACE AND SUBSURFACE SAMPLES AVAILABLE, MAXIMUM CONCENTRATION USED IN CALCULATION OF UCL

SYMBOL	METAL	CONCORD TIDAL AREA AMBIENT	RWQCB SAN FRANCISCO BAY AMBIENT	WHOLE SITE 95% UCL	AQUATIC HABITAT 95% UCL	WETLAND AND UPLAND TRANSITIONAL 95% UCL
As	Arsenic	27	15.3	28.7	29.2	37.6
Cr	Chromium	82.1	112	204	311	308
Cu	Copper	81	68.1	1094	418	1690
Pb	Lead	95	43.2	1126	747	1690
Zn	Zinc	264	158	1309	1040	1660

15 0 15 30
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

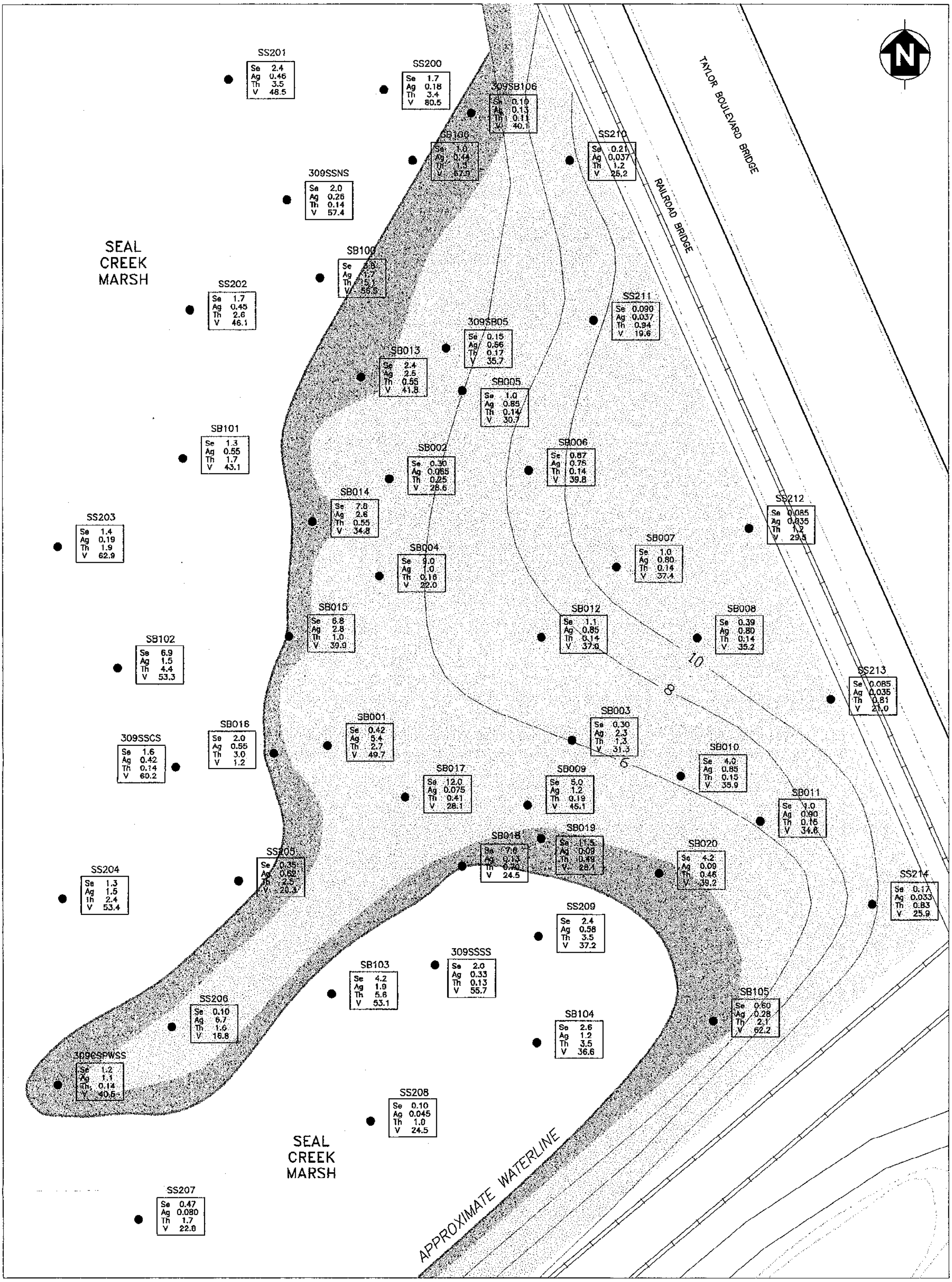
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 5-23
CONCENTRATIONS OF ARSENIC, CHROMIUM, COPPER, LEAD, AND ZINC IN SEDIMENT (in mg/kg)
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

KCH (SF) (089-309) 528CSAMPS.DWG 07/27/00 REV.001

DS.0309.15133



LEGEND:

- ● SAMPLE LOCATION
- WETLAND AND UPLAND TRANSITIONAL HABITAT
- AQUATIC HABITAT
- APPROXIMATE SEASONAL WATER LEVEL VARIATION
- APPROXIMATE SHORELINE
- —6— ELEVATION CONTOURS
- NA NOT ANALYZED
- mg/kg MILLIGRAMS PER KILOGRAM
- UCL UPPER CONFIDENCE LEVEL OF THE MEAN

NOTES:

1. ONE-HALF THE DETECTION LIMIT SUBSTITUTED FOR NONDETECTS
2. FOR LOCATIONS WHERE SURFACE AND SUBSURFACE SAMPLES AVAILABLE, MAXIMUM CONCENTRATION USED IN CALCULATION OF UCL

SYMBOL	ANALYTE	CONCORD TIDAL AREA AMBIENT	RWQCB SAN FRANCISCO BAY AMBIENT	WHOLE SITE 95% UCL	AQUATIC HABITAT 95% UCL	WETLAND AND UPLAND TRANSITIONAL 95% UCL
Se	Selenium	NA	0.64	3.2	3.7	3.8
Ag	Silver	NA	0.58	1.3	1.1	1.6
Th	Thallium	2.2	NA	1.7	2.36	0.95
V	Vanadium	96	NA	42	48.3	36

15 0 15 30
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

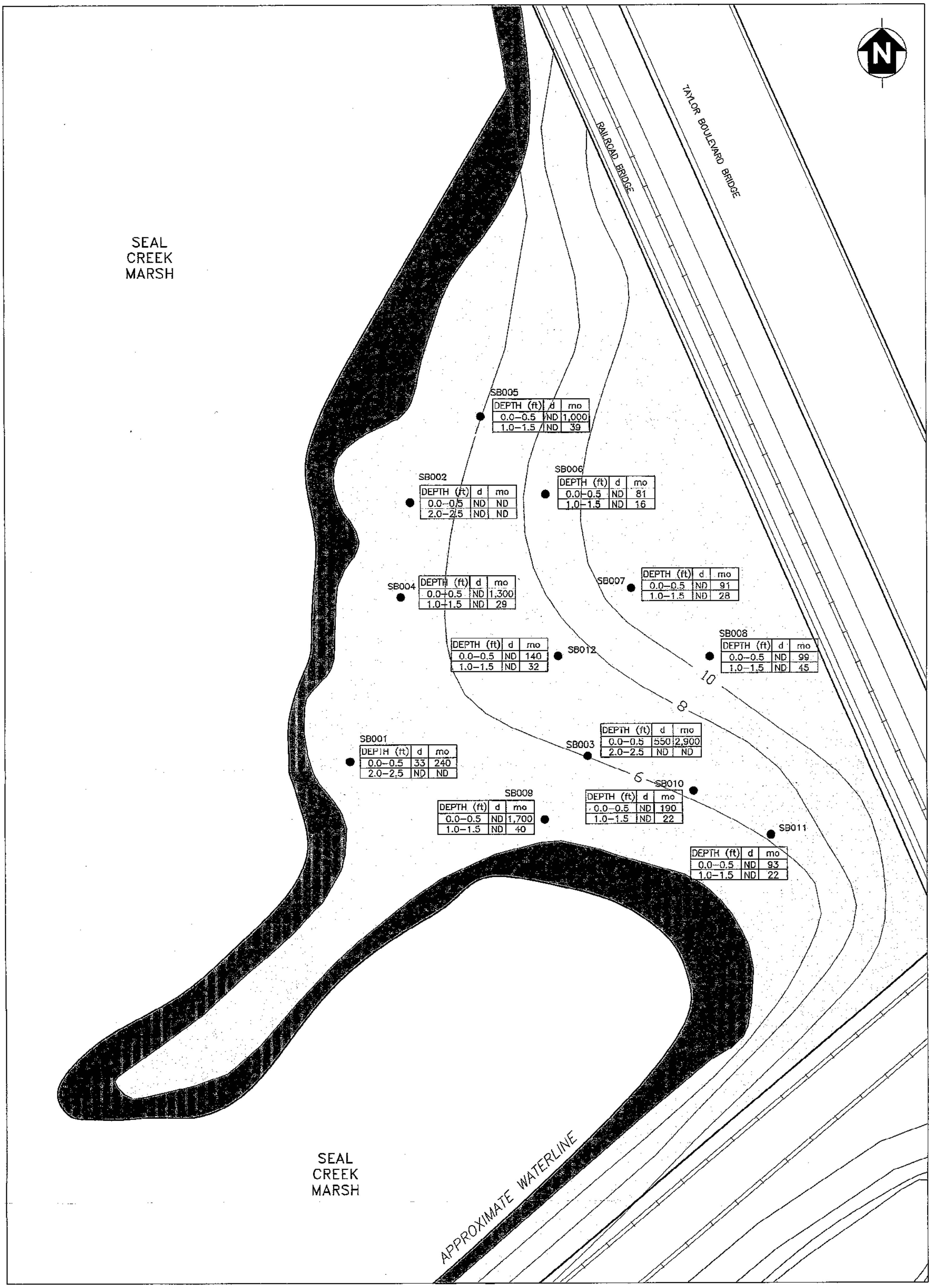
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 5-24
CONCENTRATIONS OF SELENIUM, SILVER, THALLIUM, AND VANADIUM IN SEDIMENT (in mg/kg)
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

KCH (SF) (068-309) 55BOXSAMPS.DWG 08/03/00 REV.00

DS.0309.15133



LEGEND:

● SAMPLE LOCATION

DEPTH (ft)	d	mo
0.0-0.5	33	240
1.0-1.5	ND	ND

=CONCENTRATION OF MOTOR OIL (mo) IN mg/kg (ND=NOT DETECTED)

=CONCENTRATION OF DIESEL (d) IN mg/kg (ND=NOT DETECTED)

mg/kg MILLIGRAMS PER KILOGRAM

ft FEET

WETLAND AND UPLAND TRANSITIONAL HABITAT

AQUATIC HABITAT

SHORELINE: APPROXIMATE SEASONAL WATER LEVEL VARIATION

APPROXIMATE SHORELINE

—6— ELEVATION CONTOURS

15 0 15 30

SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

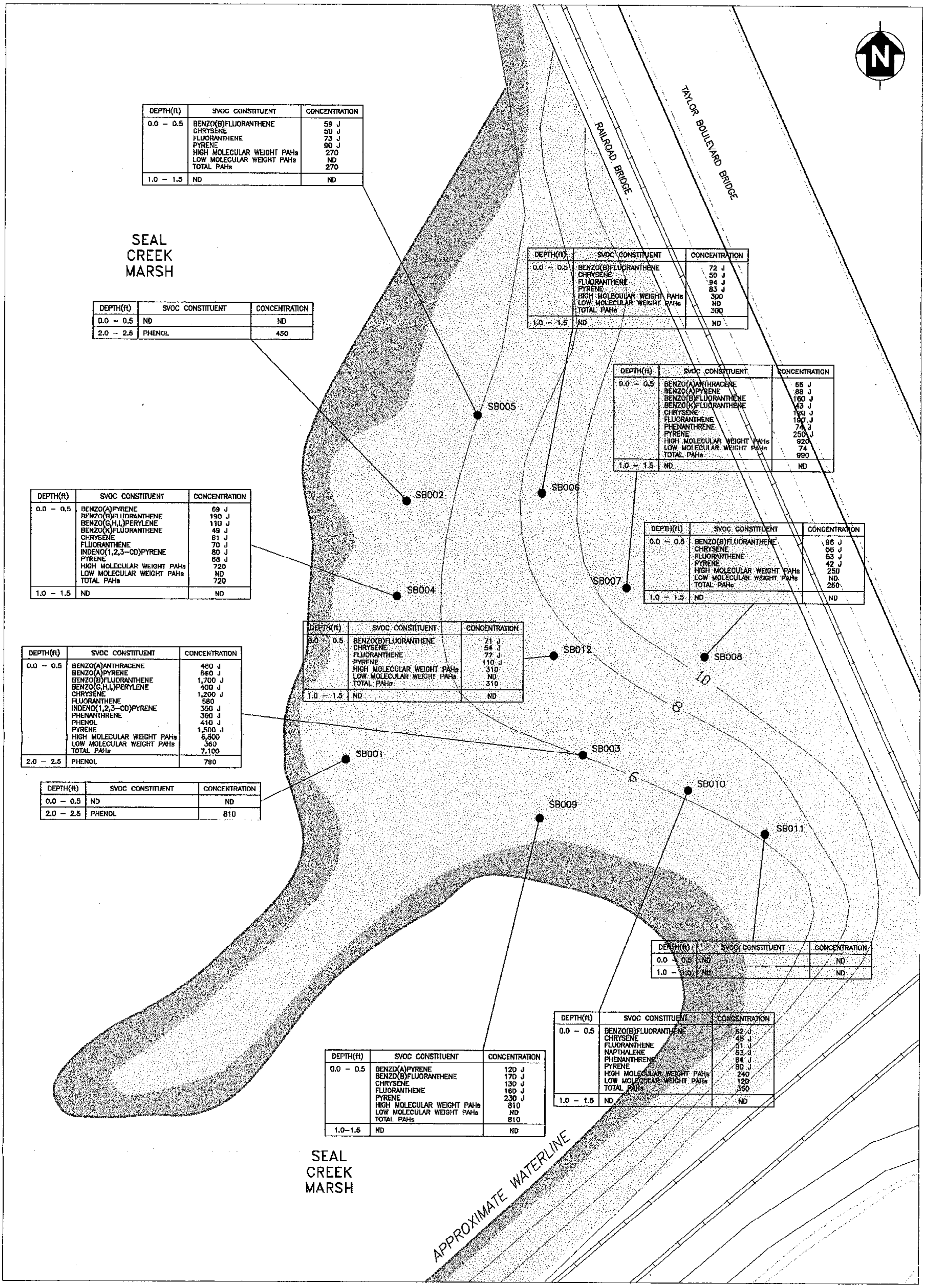
ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 5-25

PETROLEUM HYDROCARBON CONCENTRATIONS IN SEDIMENT TAYLOR BOULEVARD BRIDGE DISPOSAL SITE



DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	BENZO(B)FLUORANTHENE	59 J
	CHRYSENE	50 J
	FLUORANTHENE	73 J
	PYRENE	90 J
	HIGH MOLECULAR WEIGHT PAHs	270
	LOW MOLECULAR WEIGHT PAHs	ND
	TOTAL PAHs	270
1.0 – 1.5	ND	ND

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	BENZO(B)FLUORANTHENE	72 J
	CHRYSENE	50 J
	FLUORANTHENE	94 J
	PYRENE	83 J
	HIGH MOLECULAR WEIGHT PAHs	300
	LOW MOLECULAR WEIGHT PAHs	ND
	TOTAL PAHs	300
1.0 – 1.5	ND	ND

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	ND	ND
2.0 – 2.5	PHENOL	450

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	BENZO(A)ANTHRACENE	55 J
	BENZO(A)PYRENE	88 J
	BENZO(B)FLUORANTHENE	160 J
	BENZO(K)FLUORANTHENE	43 J
	CHRYSENE	120 J
	FLUORANTHENE	190 J
	PHENANTHRENE	74 J
	PYRENE	250 J
	HIGH MOLECULAR WEIGHT PAHs	920
	LOW MOLECULAR WEIGHT PAHs	74
	TOTAL PAHs	990
1.0 – 1.5	ND	ND

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	BENZO(A)PYRENE	69 J
	BENZO(B)FLUORANTHENE	190 J
	BENZO(G,H,I,)PERYLENE	110 J
	BENZO(K)FLUORANTHENE	49 J
	CHRYSENE	81 J
	FLUORANTHENE	70 J
	INDENO(1,2,3-CD)PYRENE	80 J
	PYRENE	88 J
	HIGH MOLECULAR WEIGHT PAHs	720
	LOW MOLECULAR WEIGHT PAHs	ND
	TOTAL PAHs	720
1.0 – 1.5	ND	ND

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	BENZO(B)FLUORANTHENE	96 J
	CHRYSENE	56 J
	FLUORANTHENE	53 J
	PYRENE	42 J
	HIGH MOLECULAR WEIGHT PAHs	250
	LOW MOLECULAR WEIGHT PAHs	ND.
	TOTAL PAHs	250
1.0 – 1.5	ND	ND

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	BENZO(B)FLUORANTHENE	71 J
	CHRYSENE	54 J
	FLUORANTHENE	77 J
	PYRENE	110 J
	HIGH MOLECULAR WEIGHT PAHs	310
	LOW MOLECULAR WEIGHT PAHs	ND
	TOTAL PAHs	310
1.0 – 1.5	ND	ND

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	BENZO(A)ANTHRACENE	480 J
	BENZO(A)PYRENE	560 J
	BENZO(B)FLUORANTHENE	1,700 J
	BENZO(G,H,I,)PERYLENE	400 J
	CHRYSENE	1,200 J
	FLUORANTHENE	580
	INDENO(1,2,3-CD)PYRENE	350 J
	PHENANTHRENE	360 J
	PHENOL	410 J
	PYRENE	1,500 J
	HIGH MOLECULAR WEIGHT PAHs	6,800
	LOW MOLECULAR WEIGHT PAHs	360
	TOTAL PAHs	7,100
2.0 – 2.5	PHENOL	780

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	ND	ND
2.0 – 2.5	PHENOL	810

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	ND	ND
1.0 – 1.5	ND	ND

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	BENZO(B)FLUORANTHENE	62 J
	CHRYSENE	45 J
	FLUORANTHENE	51 J
	NAPTHALENE	53 J
	PHENANTHRENE	64 J
	PYRENE	80 J
	HIGH MOLECULAR WEIGHT PAHs	240
	LOW MOLECULAR WEIGHT PAHs	120
	TOTAL PAHs	360
1.0 – 1.5	ND	ND

DEPTH(ft)	SVOC CONSTITUENT	CONCENTRATION
0.0 – 0.5	BENZO(A)PYRENE	120 J
	BENZO(B)FLUORANTHENE	170 J
	CHRYSENE	130 J
	FLUORANTHENE	160 J
	PYRENE	230 J
	HIGH MOLECULAR WEIGHT PAHs	810
	LOW MOLECULAR WEIGHT PAHs	ND
	TOTAL PAHs	810
1.0–1.5	ND	ND

LEGEND:

- ● SAMPLE LOCATION
- SVOC SEMIVOLATILE ORGANIC COMPOUNDS
- J ESTIMATED CONCENTRATION
- ND NO SVOCs DETECTED
- PAH POLYCYCLIC AROMATIC HYDROCARBON

- —6— ELEVATION CONTOURS
- WETLAND AND UPLAND TRANSITIONAL HABITAT
- AQUATIC HABITAT
- APPROXIMATE SEASONAL WATER LEVEL VARIATION
- APPROXIMATE SHORELINE

NOTES:

1. ALL CONCENTRATIONS ARE MICROGRAMS PER KILOGRAM
2. TABLES LIST DETECTED SVOCs

15 0 15 30
SCALE IN FEET

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 5-26
DETECTED SVOC CONCENTRATIONS
IN SEDIMENT SAMPLES
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

KCH (SF) (089-309) 5XSVOCSAMPS.DWG 08/01/00 REV.001

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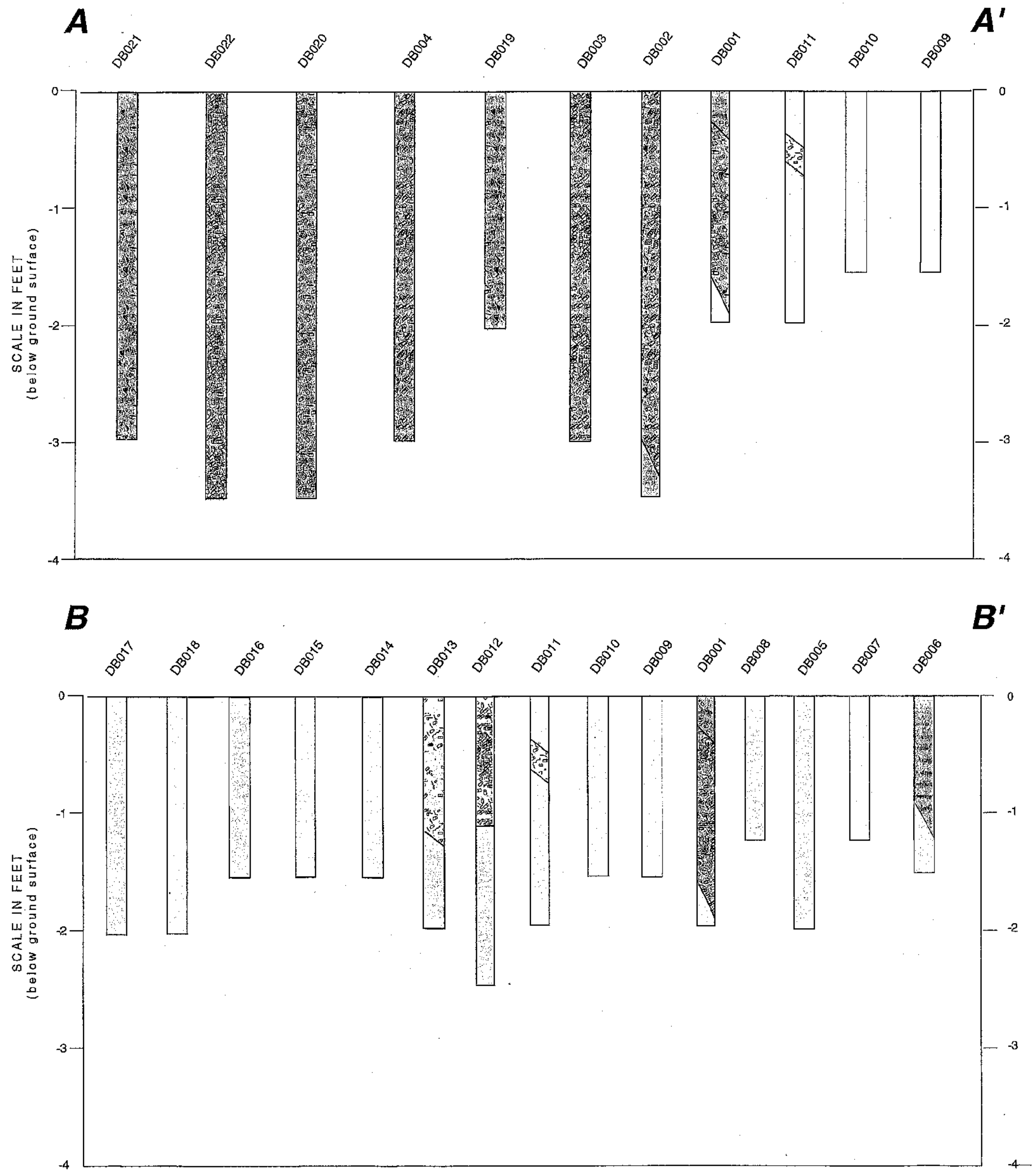

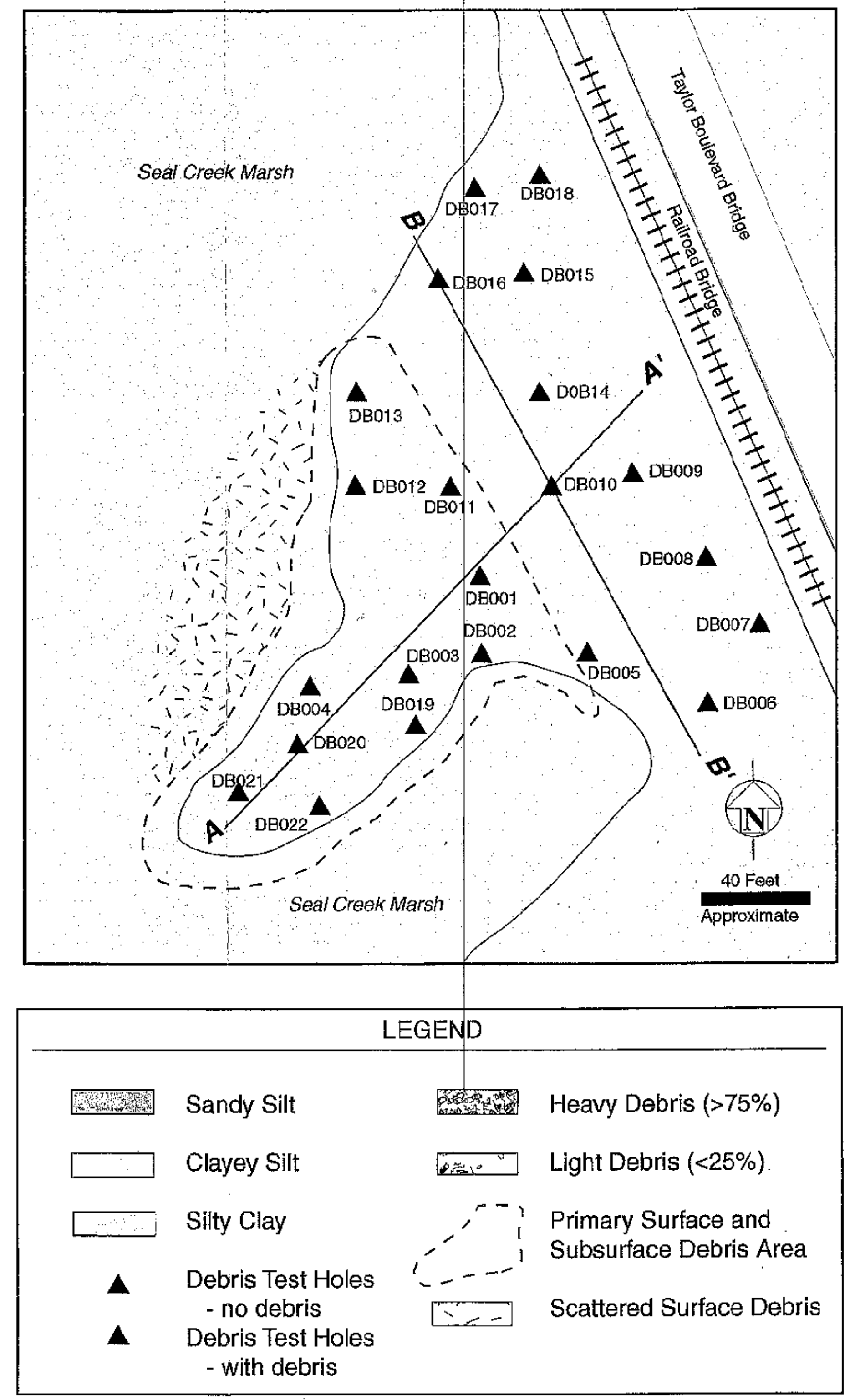

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD — CONCORD, CALIFORNIA

FIGURE 5-27
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
DEBRIS TEST HOLE PROFILES

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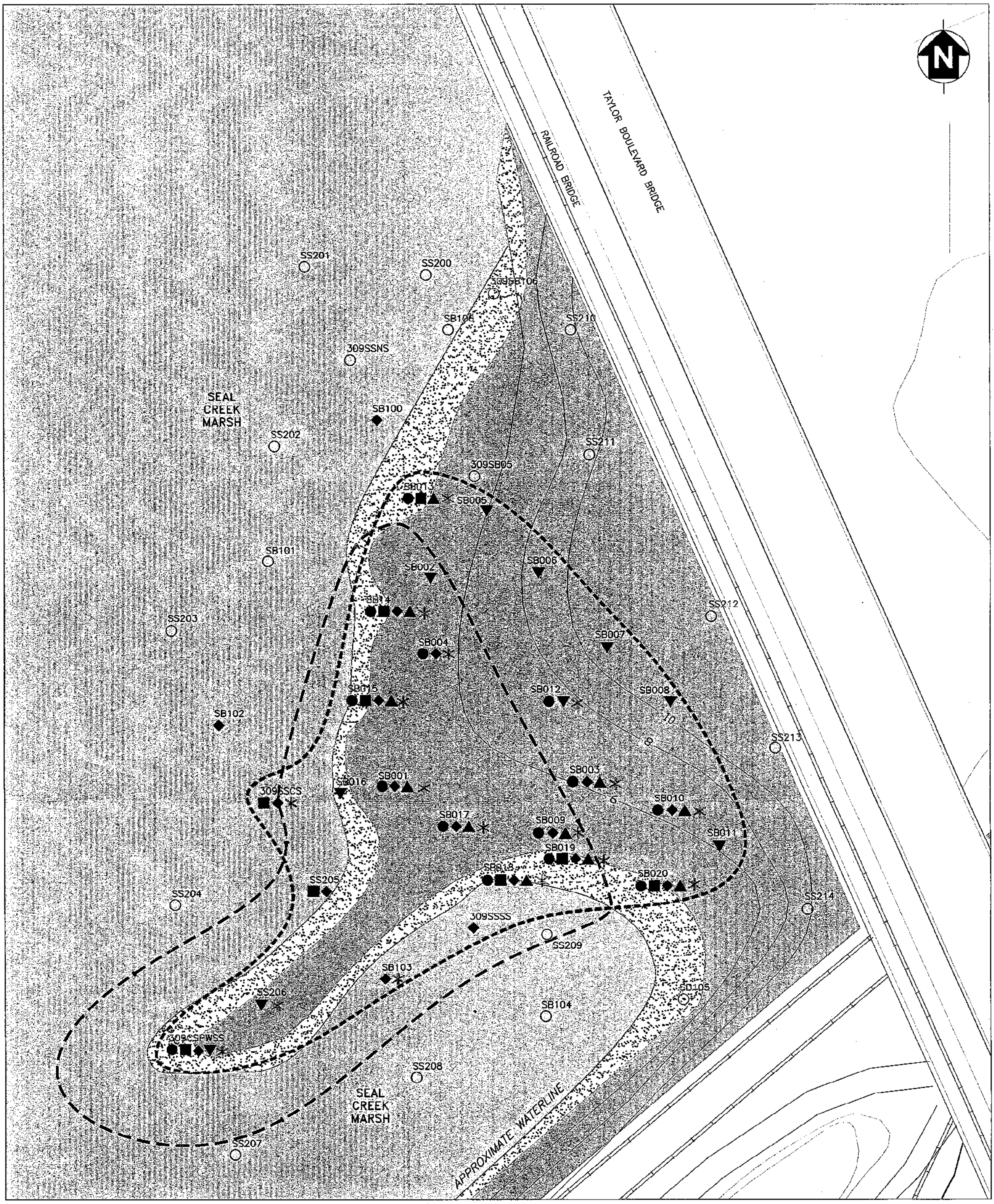

LEGEND:

- ○ MINIMAL RISK TO ASSESSMENT ENDPOINT RECEPTORS
- ✳ RISK TO HUMAN HEALTH; LEAD PRG > 400 mg/kg.
- ● RISK TO PLANTS INDICATED; SAMPLE LOCATION HAS FIVE OR MORE HQs GREATER THAN 1.0
- ■ RISK TO BENTHIC INVERTEBRATES INDICATED; ONE OR MORE MEAN ER-Mq GREATER THAN 1.5
- ◆ RISK TO BIRDS INDICATED; SAMPLE LOCATION HAS ONE OR MORE METAL CONCENTRATIONS GREATER THAN 95th PERCENT UCL
- ▲ RISK TO SALT MARSH HARVEST MICE INDICATED; SAMPLE LOCATION HAS TWO OR MORE HQ (Low Dose/High TRV) GREATER THAN 1.0
- ▼ RISK TO SALT MARSH HARVEST MICE INDICATED; SAMPLE LOCATION HAS TWO OR MORE HQ (High Dose/High TRV) GREATER THAN 1.0
- WETLAND AND UPLAND TRANSITIONAL HABITAT
- AQUATIC HABITAT
- SHORELINE: APPROXIMATE SEASONAL WATER LEVEL VARIATION
- SAMPLES 309SSNS, 309SSSS, AND 309SSCS ARE COMPOSITES POOLED FROM THREE SEDIMENT SAMPLES
- APPROXIMATE SHORELINE
- APPROXIMATE EXTENT OF DEBRIS
- APPROXIMATE RISK FOOTPRINT

20 0 20 40
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 7-1
ESTIMATED RISK
TO
ASSESSMENT ENDPOINT RECEPTORS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

DS.0309.15133

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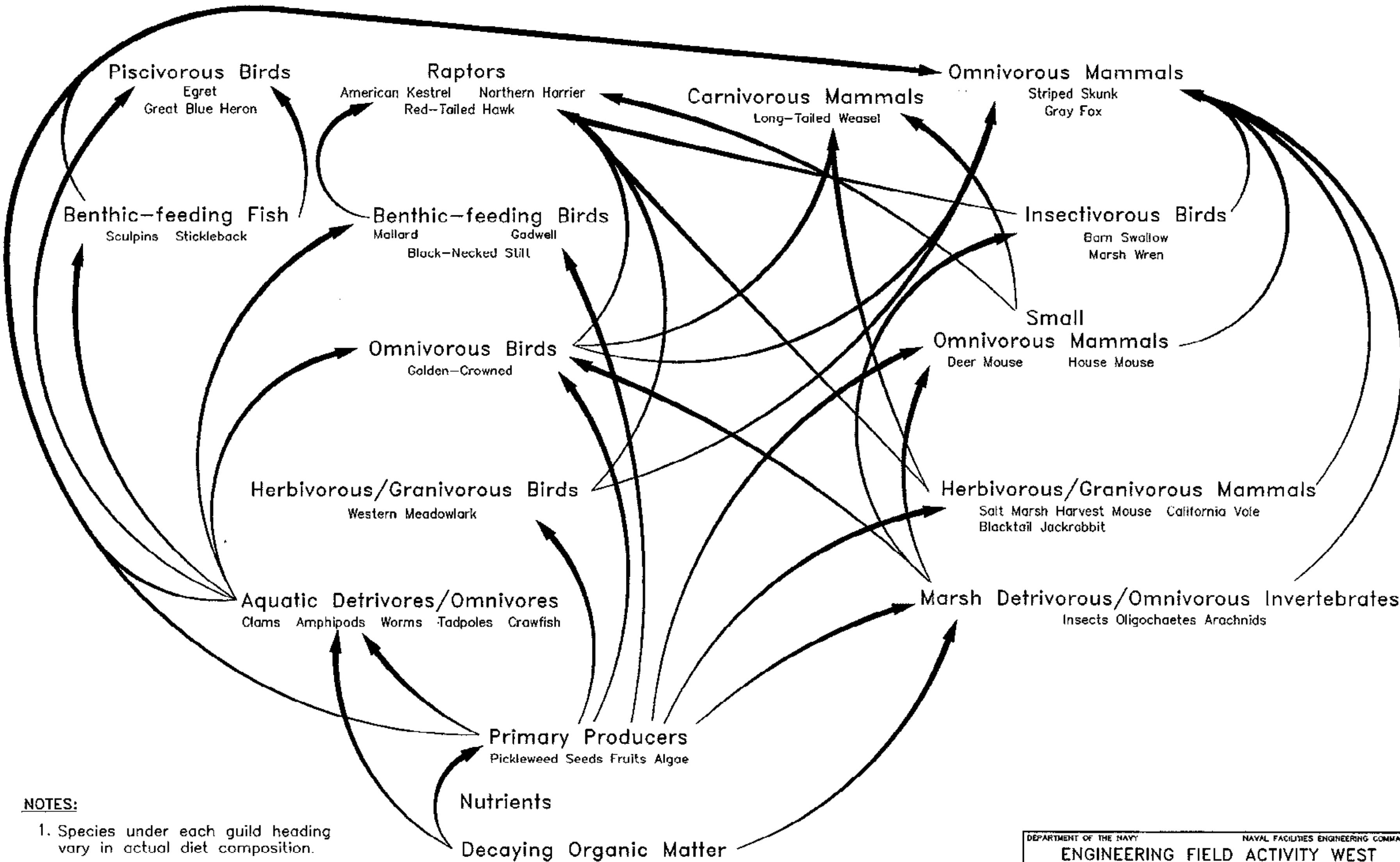
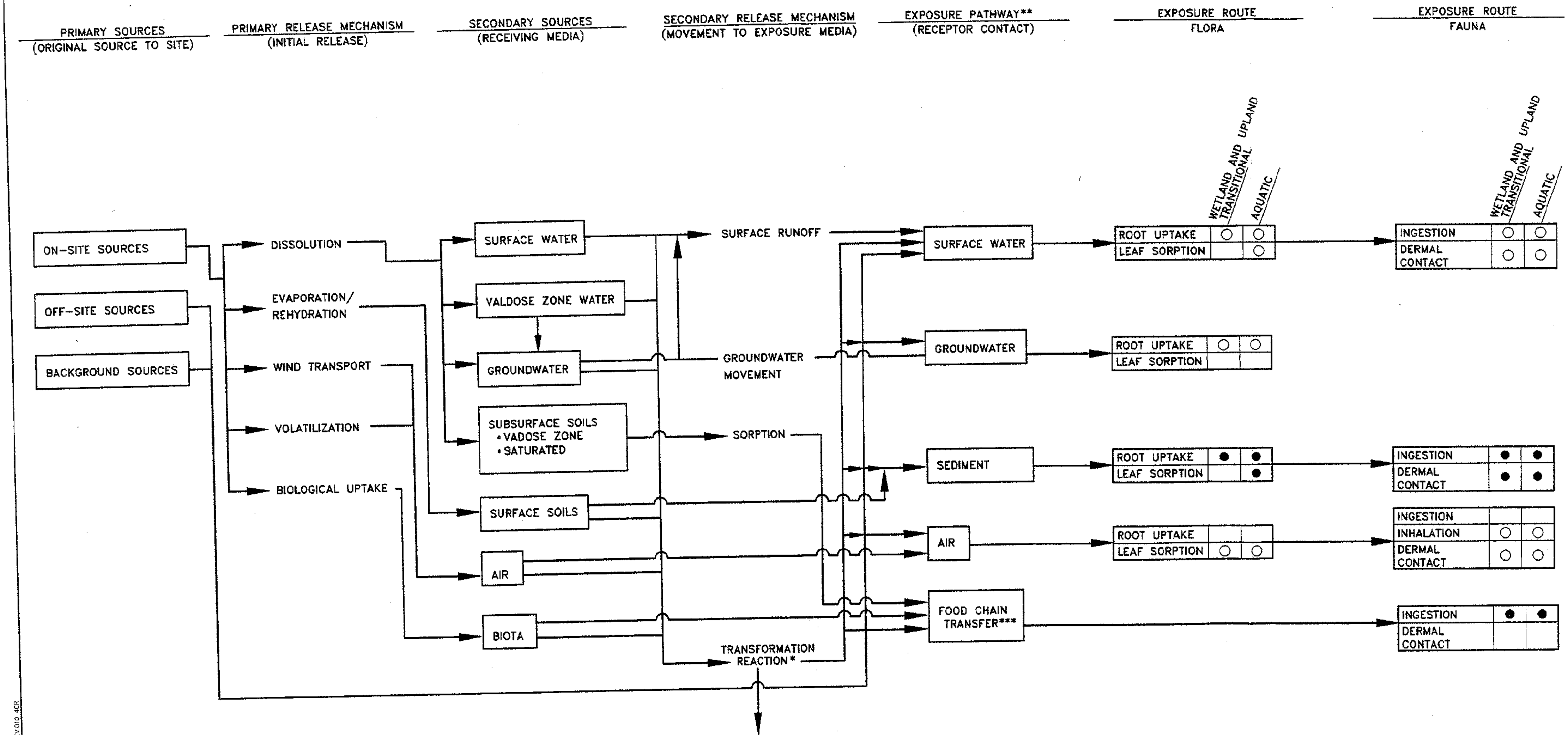


NOTES:

1. Species under each guild heading vary in actual diet composition.
2. The habitat provided at the TTB disposal area is minimal due to its small size, consequently, use of the site by top level receptors is expected to be minimal.

DEPARTMENT OF THE NAVY	NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY WEST SAN BRUNO, CALIFORNIA	
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD	
FIGURE 8-1 FOOD WEB AQUATIC AND WETLEND/UPLAND TRANSITIONAL HABITATS TAYLOR BOULEVARD BRIDGE DISPOSAL SITE	



LEGEND

* TRANSFORMATION REACTIONS MAY ALSO OCCUR AS A PRIMARY RELEASE MECHANISM

** ADDITIONAL INTERACTION MAY OCCUR BETWEEN EACH OF THESE PATHWAYS THAT MAY NOT BE SHOWN

*** INCLUDES DETRITIVORES AND CONSUMERS

● MAJOR EXPOSURE ROUTES (EVALUATED IN BASELINE ERA)

○ MINOR EXPOSURE ROUTES (NOT EVALUATED IN BASELINE ERA)

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

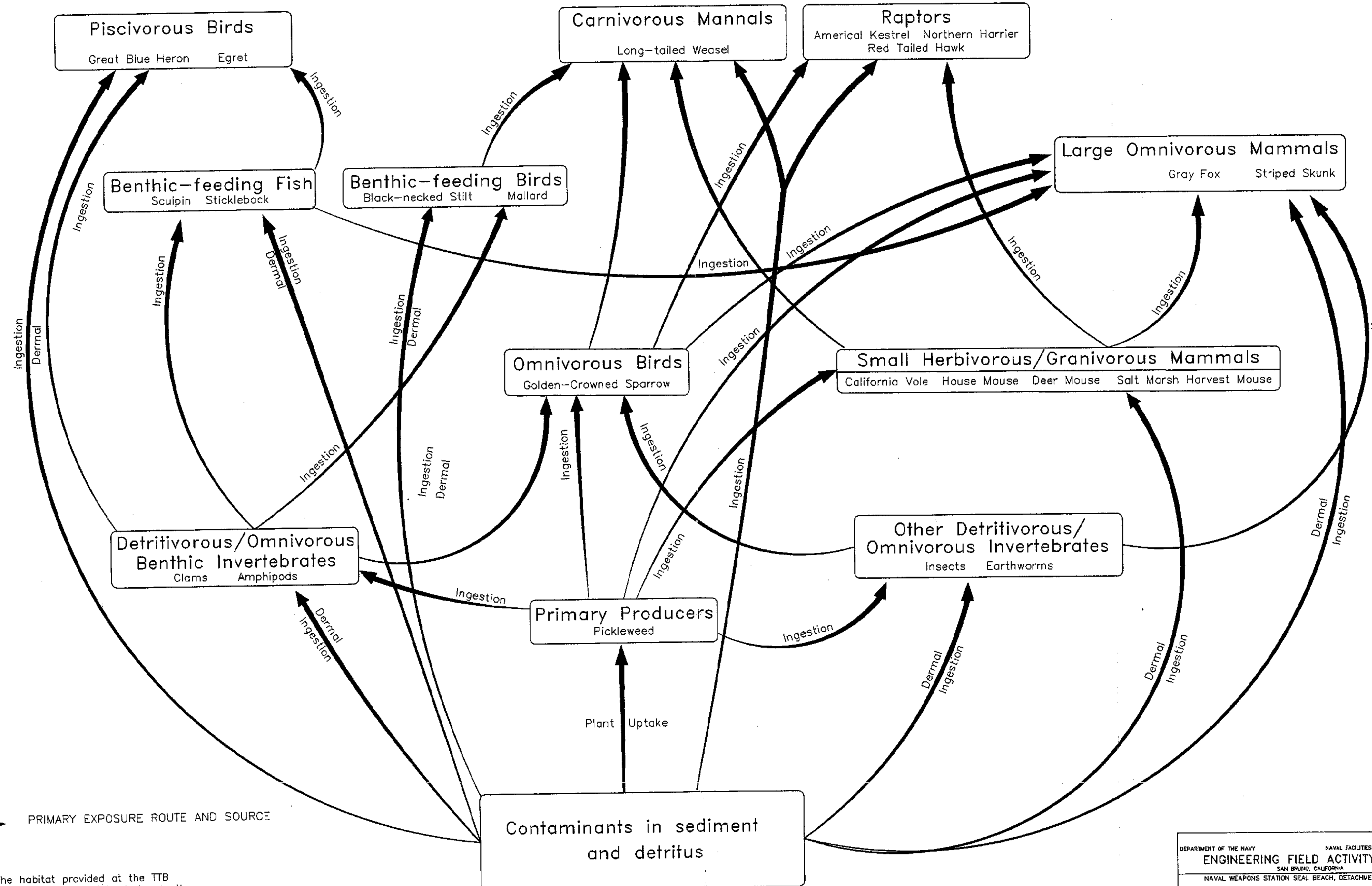
ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 8-2

POTENTIAL EXPOSURE ROUTES
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE



LEGEND

PRIMARY EXPOSURE ROUTE AND SOURCE

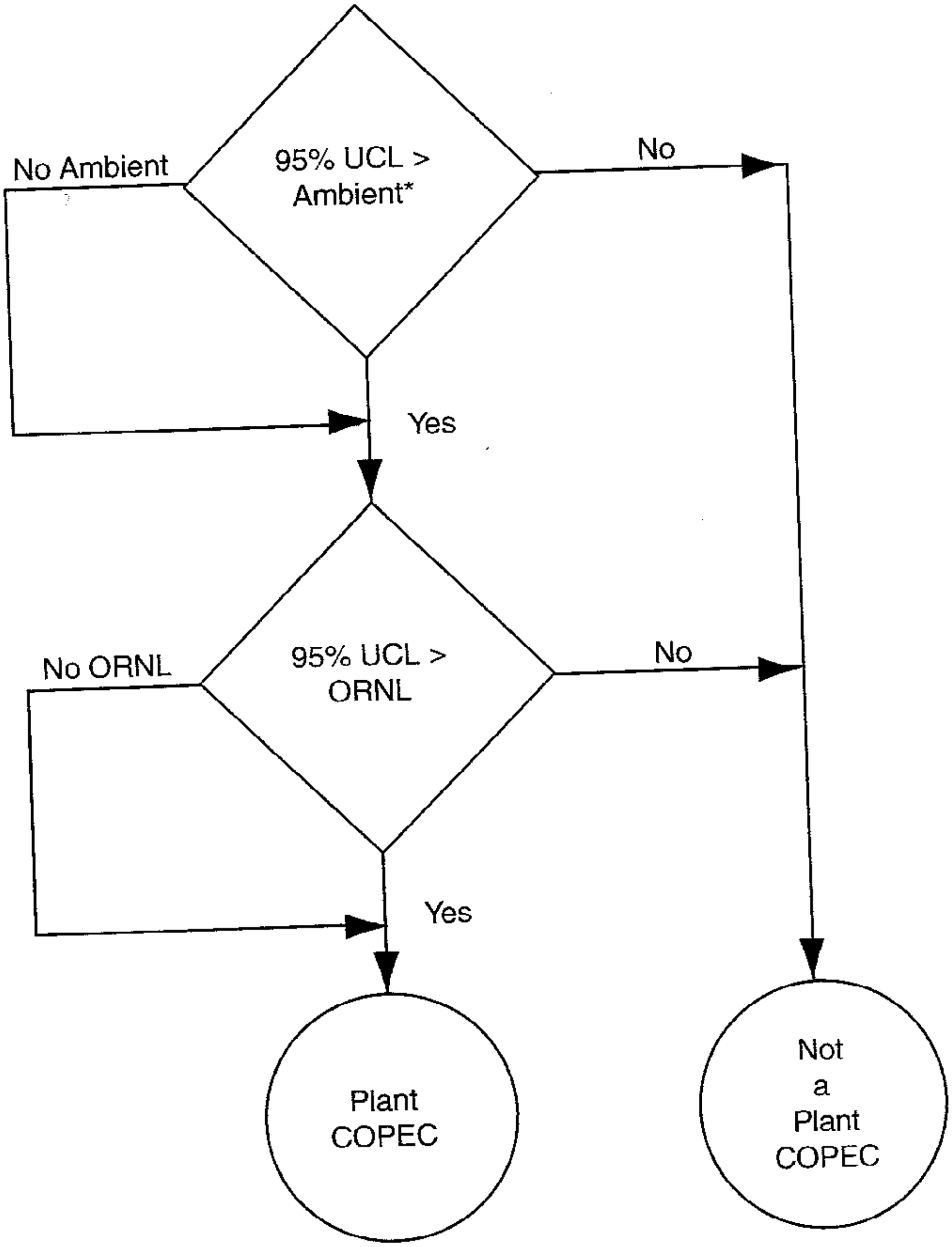
NOTE:

1. The habitat provided at the TTB disposal area is minimal due to its small size, consequently, use of the site by top level receptors is expected to be minimal.

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 8-3
CONTAMINANT EXPOSURE AND FLOW DIAGRAM FOR TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

DS.0309.15133



* Ambient = Most conservative of RWQCB San Franicsco Bay or Tidal Area ambient

95% UCL of mean was calculated using 1/2 the detection limit for nondetects

COPEC = Chemical of potential ecological concern

UCL = Upper confidence limit

ORNL = Oak Ridge National Laboratory

RWQCB = Regional Water Quality Control Board

DEPARTMENT OF THE NAVY | NAVAL FACILITIES ENGINEERING COMMAND

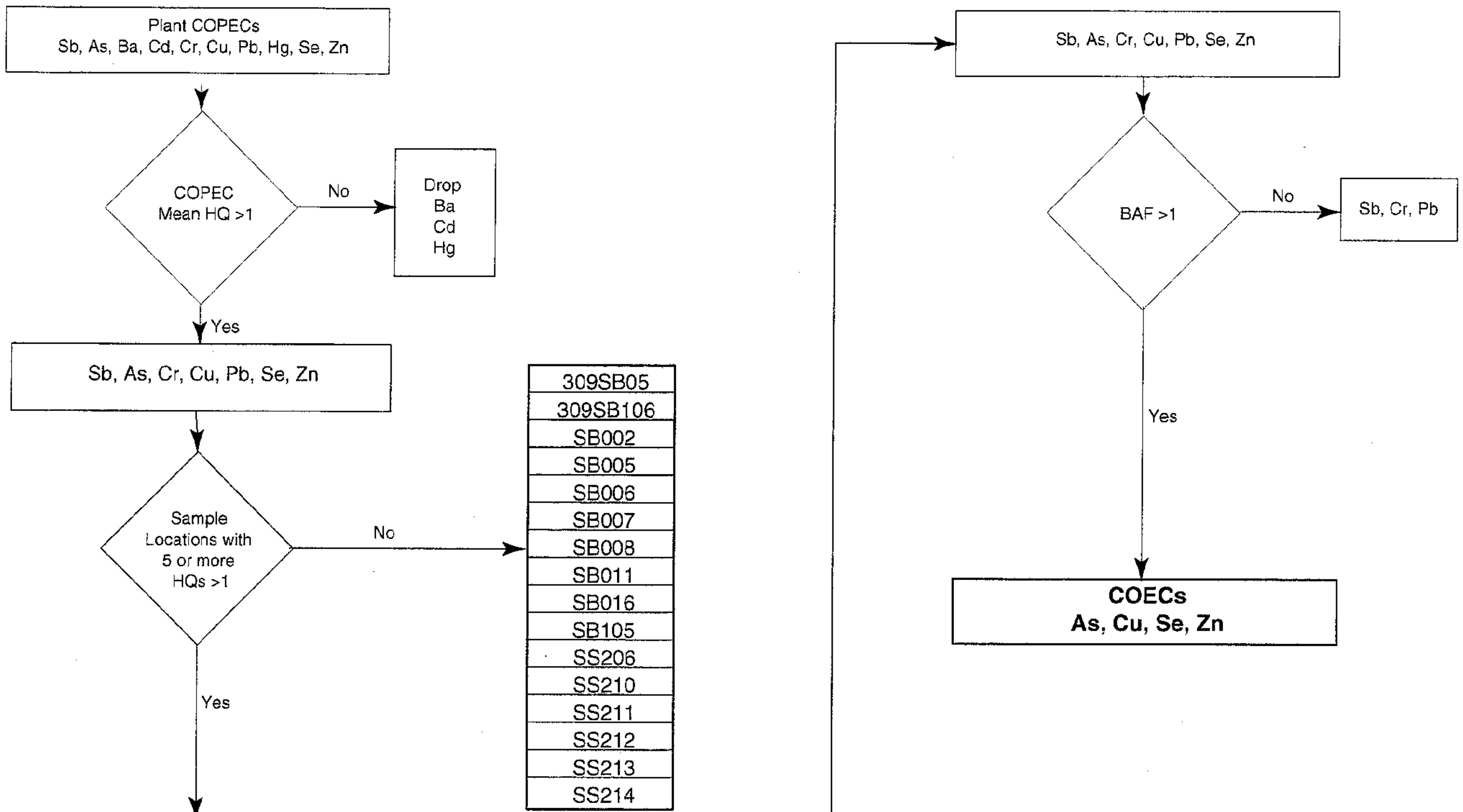
ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH,

FIGURE 8-4
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN (COPEC)
PROCESS FLOW CHART FOR WETLAND AND UPLAND TRANSITIONAL PLANTS

DS.0309.15133



Sample Location	Sb	As	Cr	Cu	Pb	Se	Zn
309CSPWSS	1.3	5.7	3.7	6.2	46.0	1.2	45.4
SB001	1.1	5.8	6.8	12.2	51.2	0.42	81.8
SB003	16.8	14.2	6.3	133	154	0.30	79.2
SB004	3.6	6.1	6.0	7.6	101	9.0	42.0
SB009	1.2	3.8	2.2	6.5	31.2	5.0	108
SB010	6.4	3.4	5.0	250	37.4	4.0	99.2
SB012	1.0	0.66	1.4	1.4	15.0	1.1	3.9
SB013	0.50	2.0	2.3	20.6	11.9	2.4	18.2
SB014	1.3	6.1	3.9	5.4	65.6	7.8	33.2
SB015	5.3	5.8	150	14.5	20.4	6.8	30.8
SB017	0.078	0.034	8.7	10.3	40.6	12.0	41.2
SB018	1.2	10.6	2.4	33.4	25.4	7.6	22.6
SB019	0.76	5.3	4.3	8.6	32.8	11.5	14.7
SB020	0.54	2.3	3.7	39.6	23.6	4.2	36.0

EXPLANATION

As, Arsenic.
Ba, Barium.
BAF, Bioaccumulation factor.
Cd, Cadmium.
COECs, Chemicals of ecological concern.
COPECs, Chemicals of potential ecological concern.
Cr, Chromium.
Cu, Copper.
Hg, Mercury.
HQ, Hazard quotient, see note below.
NA, not applicable.
ORNL, Oak Ridge National Laboratory.
Pb, Lead.
Sb, Antimony.
Se, Selenium.
Zn, Zinc.

Hazard quotients (HQ) were calculated by dividing the COPEC concentration at that sample location by the ORNL plant toxicity benchmark for that COPEC.

Mean hazard quotients (mean HQ) were calculated by summing hazard quotients for one COPEC across sample locations and dividing that sum by the number of sample locations at which that COPEC was present.

Bioaccumulation factors were calculated by dividing the plant tissue metal concentration (milligrams/kilogram dry weight) by the sediment metal concentration (milligrams/kilogram dry weight).

Efroynison, R.A., and others. 1997. "Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision." Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER.TM-85.

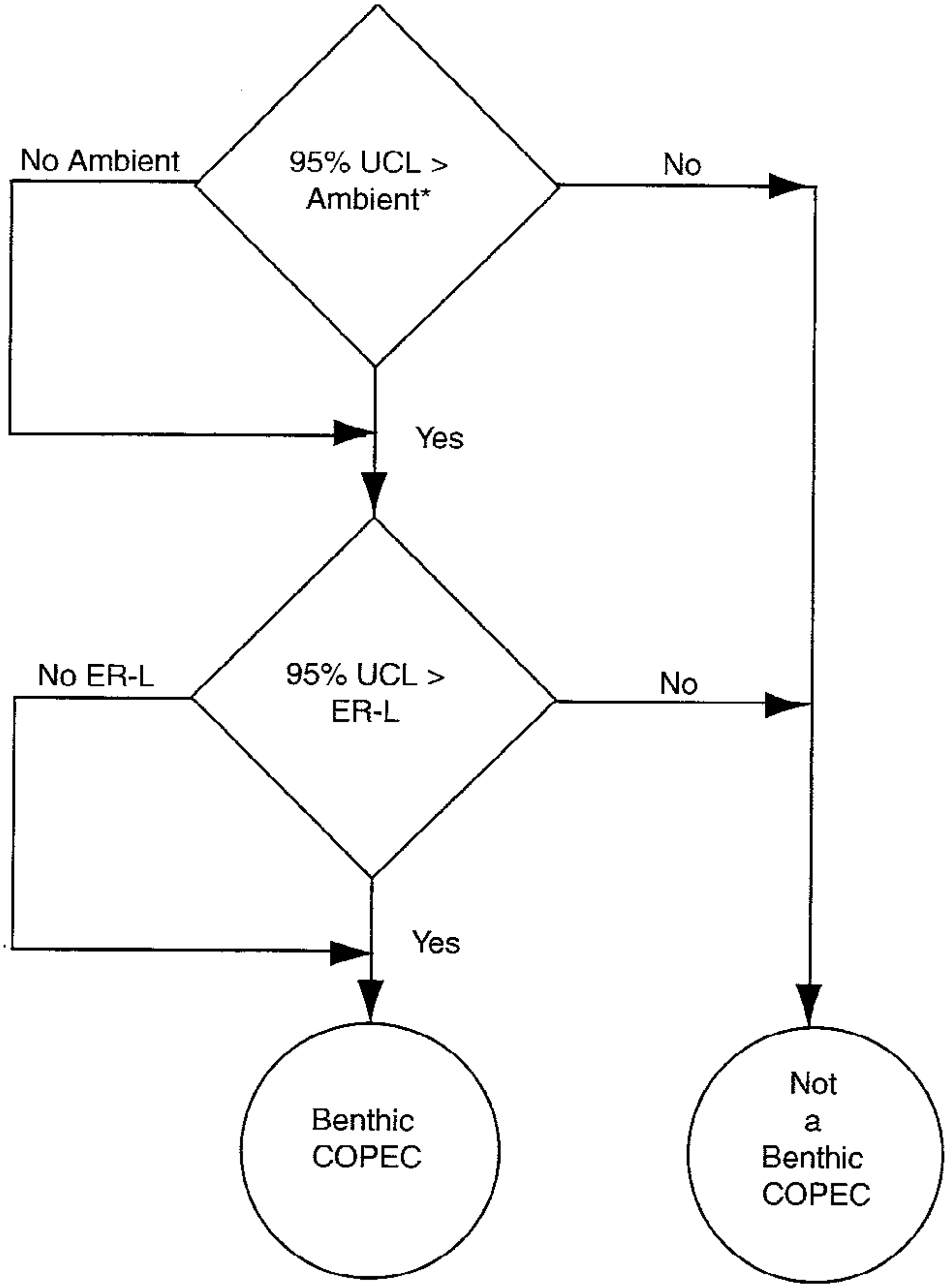
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 8-5
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE CHEMICALS OF ECOLOGICAL CONCERN (COEC) PROCESS FLOW CHART FOR WETLAND AND UPLAND TRANSITIONAL PLANTS

DS.0309.15133



* Ambient = Most conservative of RWQCB San Franicsco Bay or Tidal Area ambient

95% UCL was calculated using 1/2 the detection limit for nondetects

COPEC = Chemical of potential ecological concern

UCL = Upper confidence limit

ER-L = Effects range - low

RWQCB = Regional Water Quality Control Board

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

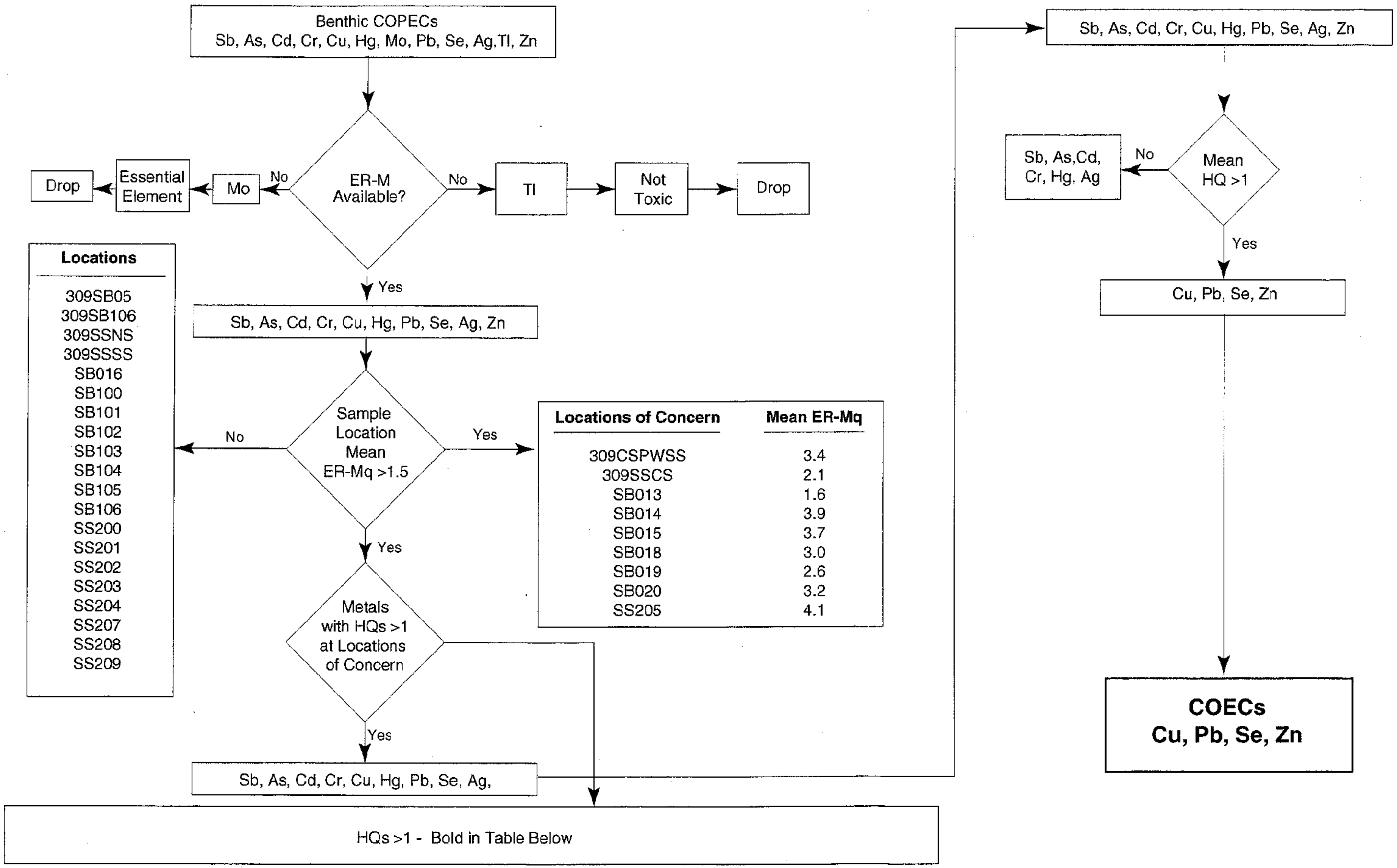
ENGINEERING FIELD ACTIVITY WEST

SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 8-6
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN (COPEC) PROCESS FLOW CHART FOR BENTHIC INVERTEBRATES

DS.0309.15133



Sample Location	Sb	As	Cd	Cr	Cu	Pb	Hg	Se	Ag	Zn
309CSPWSS	0.29	0.81	0.81	0.20	**1.2**	**10.6**	0.55	0.86	0.29	**15.1**
309SSCS	0.13	0.47	0.25	0.14	0.48	**2.5**	0.70	**1.1**	0.11	**13.2**
SB013	0.11	0.28	0.0037	0.12	**3.8**	**2.7**	0.90	**1.7**	0.68	**6.1**
SB014	0.28	0.88	0.0036	0.21	1.0	**15.0**	0.27	**5.6**	0.70	**11.1**
SB015	**1.1**	0.82	0.0068	**8.1**	**2.7**	**4.7**	0.10	**4.9**	0.76	**10.3**
SB018	0.25	**1.5**	0.0048	0.13	**6.2**	**5.8**	0.30	**5.4**	0.034	**7.5**
SB019	0.17	0.75	0.0034	0.23	**1.6**	**7.5**	0.20	**8.2**	0.024	**4.9**
SB020	0.12	0.33	0.0031	0.20	**7.3**	**5.4**	0.042	**3.0**	0.023	**12.0**
SS205	0.091	0.38	0.25	0.041	0.61	**1.7**	0.0070	0.25	0.17	**33.2**
Mean HQ	0.29	0.69	0.15	1.0	**2.8**	**6.2**	0.34	**3.5**	0.31	**12.6**

EXPLANATION

As, Arsenic.
COECs, Chemicals of ecological concern.
COPECs, Chemicals of potential ecological concern.
Cd, Cadmium.
Cr, Chromium.
Cu, Copper.
ER-M, Effects range-median. After Long and others (1995).
Hg, Mercury
HQs, Hazard quotients. See note below.
Mean ER-Mq, mean effects range-median quotient. After Long and MacDonald (1998). See note below.
Mean HQ, Mean hazard quotient. See note below.
Mo, Molybdenum.
Pb, Lead.
Sb, Antimony.
Se, Selenium.
Tl, Thallium.
Ag, Silver.
Zn, Zinc.

Hazard quotients (HQ) were calculated by dividing the COPEC concentration at that sample location by the ER-M for that COPEC.

Mean ER-Mq quotients (mean ER-Mq) were calculated by summing hazard quotients for one sample location across COPECs and dividing that sum by the number of COPECs present at that sample location.

Mean hazard quotients (mean HQ) were calculated by summing hazard quotients for one COPEC across sample locations and dividing that sum by the number of sample locations at which the ER-Mq was greater than 1.5.

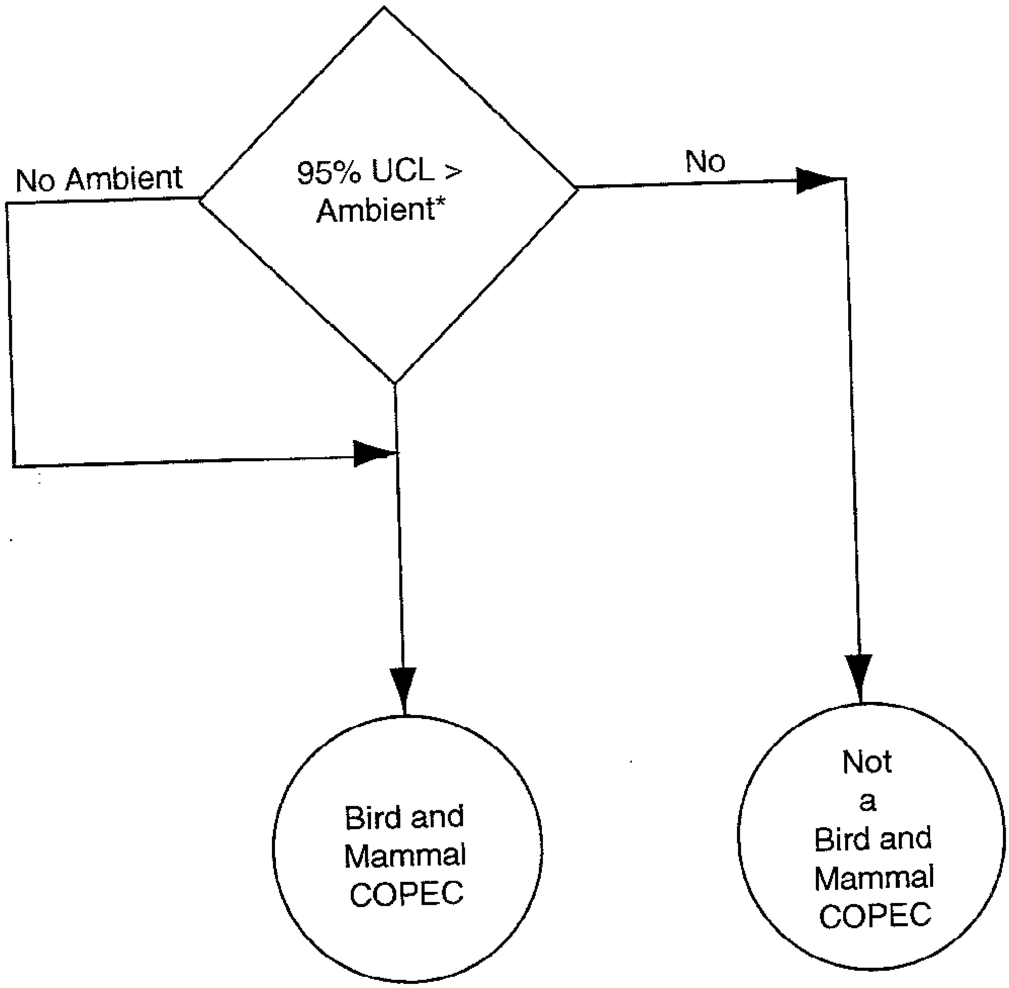
Long, E.R., D.D. MacDonald, S.L. Smith, F.D. Calder, 1995. "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management 19(1):81-97.

Long, E.R. and D.D. MacDonald, 1998. "Recommended Uses of Empirically Derived, Sediment Quality Guidelines for Marine and Estuarine Ecosystems." *Human Ecological Risk Assessment*, Volume 4, Number 5, Pages 1019 through 1039.

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 8-7
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE CHEMICALS OF ECOLOGICAL CONCERN (COEC) PROCESS FLOW CHART FOR BENTHIC INVERTEBRATES

DS.0309.15133



* Ambient = Most conservative of RWQCB San Franicsco Bay or Tidal Area ambient

95% UCL was calculated using 1/2 the detection limit for nondetects

COPEC = Chemical of potential ecological concern

RWQCB = Regional Water Quality Control Board

UCL = Upper confidence limit

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST
SAN BRUNO, CALIFORNIA

NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

FIGURE 8-8
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN (COPEC) PROCESS FLOW CHART FOR BIRDS AND MAMMALS

DS.0309.15133

TABLES

TABLE 5-1
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
SAMPLE ANALYTE LIST

			Chemistry				Sediment Parameters				Toxicity Test	Bioaccumulation		
Sample Location	Sample Depth(s) (ft. bgs)	Habitat[a]	Metals	SVOCs	TPH-purgeable	TPH-extractable	SEM/AVS	TOC	Grain Size	pH	Amphipod Bioassay	Pickleweed Tissue	Amphipod Tissue	Sample Collection Date
309CSPWSS	0 - 0.5	shoreline	X									X - metals		February-00
309SB05	0 - 0.5	shoreline	X									X - metals		February-00
309SB106	0 - 0.5	shoreline	X									X - metals		February-00
309SSCS	0 - 0.5	aquatic	X				X	X	X	X	X		X - metals	February-00
309SSNS	0 - 0.5	aquatic	X				X	X	X	X	X		X - metals	February-00
309SSSS	0 - 0.5	aquatic	X				X	X	X	X	X		X - metals	February-00
SB001	0-0.5 and 2.0-2.5	wetland / upland	X	X	X	X								February-96
SB002	0-0.5 and 2.0-2.5	wetland / upland	X	X	X	X								February-96
SB003	0-0.5 and 2.0-2.5	wetland / upland	X	X	X	X								February-96
SB004	0-0.5 and 1.0-1.5	wetland / upland	X	X	X	X								March-97
SB005	0-0.5 and 1.0-1.5	wetland / upland	X	X	X	X								March-97
SB006	0-0.5 and 1.0-1.5	wetland / upland	X	X	X	X								March-97
SB007	0-0.5 and 1.0-1.5	wetland / upland	X	X	X	X								March-97
SB008	0-0.5 and 1.0-1.5	wetland / upland	X	X	X	X								March-97
SB009	0-0.5 and 1.0-1.5	wetland / upland	X	X	X	X								March-97
SB010	0-0.5 and 1.0-1.5	wetland / upland	X	X	X	X								March-97
SB011	0-0.5 and 1.0-1.5	wetland / upland	X	X	X	X								March-97
SB012	0-0.5 and 1.0-1.5	wetland / upland	X	X	X	X								March-97
SB013	0 - 0.5	shoreline	X											October-97
SB014	0 - 0.5	shoreline	X											October-97
SB015	0 - 0.5	shoreline	X											October-97
SB016	0 - 0.5	shoreline	X											October-97
SB017	0 - 0.5	wetland / upland	X											October-97
SB018	0 - 0.5	shoreline	X											October-97
SB019	0 - 0.5	shoreline	X											October-97
SB020	0 - 0.5	shoreline	X											October-97
SB100	0 - 0.5	aquatic	X											March-98
SB101	0 - 0.5	aquatic	X											March-98
SB102	0 - 0.5	aquatic	X											March-98
SB103	0 - 0.5	aquatic	X											March-98
SB104	0 - 0.5	aquatic	X											March-98
SB105	0 - 0.5	shoreline	X											March-98
SB106	0 - 0.5	aquatic	X											March-98
SS200	0 - 0.5	aquatic	X											June-98
SS201	0 - 0.5	aquatic	X											June-98
SS202	0 - 0.5	aquatic	X											June-98
SS203	0 - 0.5	aquatic	X											June-98
SS204	0 - 0.5	aquatic	X											June-98
SS205	0 - 0.5	aquatic	X											June-98
SS206	0 - 0.5	wetland / upland	X											June-98
SS207	0 - 0.5	aquatic	X											June-98
SS208	0 - 0.5	aquatic	X											June-98

TABLE 5-1
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
SAMPLE ANALYTE LIST

			Chemistry				Sediment Parameters				Toxicity Test	Bioaccumulation		
Sample Location	Sample Depth(s) (ft. bgs)	Habitat[a]	Metals	SVOCs	TPH-purgeable	TPH-extractable	SEM/AVS	TOC	Grain Size	pH	Amphipod Bioassay	Pickleweed Tissue	Amphipod Tissue	Sample Collection Date
SS209	0 - 0.5	aquatic	X											June-98
SS210	0 - 0.5	wetland / upland	X											June-98
SS211	0 - 0.5	wetland / upland	X											June-98
SS212	0 - 0.5	wetland / upland	X											June-98
SS213	0 - 0.5	wetland / upland	X											June-98
SS214	0 - 0.5	wetland / upland	X											June-98

Notes:

AVS - acid volatile sulfides
bgs - below ground surface
ft - feet
SVOCs - semivolatile organic compounds
SEM - simultaneously extractable metals
TOC - total organic carbon
TPH - total petroleum hydrocarbons
a - Shoreline locations are part of the wetland and upland transitional habitat and aquatic habitat

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TABLE 5-2
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
DESCRIPTIVE SAMPLING DATA

Analyte	Total No. of Samples	No. of Surface Samples	No. of Sub-surface Samples	Freq. of Detect	Min Detect (mg/kg)	Max Detect (mg/kg)	Location of Max Detect	Depth of Max Detect (bgs)	Tidal Area Ambient (mg/kg)	No. Smp > Tidal Area Ambient	SF Bay Ambient (mg/kg)	No. Smp > SF Bay Ambient
Whole Site												
Aluminum	60	48	12	60/60	3	23300	033TBB200	0 - 0.5	27,300	0	NA	NA
Antimony*	45	38	7	26/45	0.37	84.2	TBBSB003	0 - 0.5	2.2	19	NA	NA
Arsenic	60	48	12	58/60	0.34	142	TBBSB003	0 - 0.5	27	11	15.3	18
Barium	60	48	12	60/60	5.6	4660	TBBSB001	0 - 0.5	530	7	NA	NA
Beryllium	60	48	12	37/60	0.01	0.6	TBBSB001	2 - 2.5	0.18	29	NA	NA
Cadmium	60	48	12	23/60	0.31	13.4	TBBSB010	0 - 0.5	1.9	8	0.33	29
Chromium	60	48	12	60/60	0.89	2990	TBBSB015	0 - 0.5	82.1	8	112	6
Cobalt	60	48	12	57/60	4.3	37.5	TBBSB004	0 - 0.5	36	2	NA	NA
Copper	60	48	12	55/60	1.1	12500	TBBSB010	0 - 0.5	81	20	68.1	23
Lead	60	48	12	60/60	1.7	7680	TBBSB003	0 - 0.5	95	31	43.2	43
Manganese	60	48	12	60/60	0.69	2480	033TBB209	0 - 0.5	1500	7	NA	NA
Mercury	60	48	12	14/60	0.18	26.4	TBBSB003	0 - 0.5	0.32	14	0.43	11
Molybdenum	60	48	12	41/60	0.08	301	TBBSB013	0 - 0.5	6.6	7	NA	NA
Nickel	60	48	12	60/60	0.89	262	TBBSB003	0 - 0.5	120	4	112	4
Selenium	60	48	12	31/60	0.17	12	TBBSB017	0 - 0.5	DL	?	0.64	46
Silver	60	48	12	17/60	0.13	6.7	033TBB206	0 - 0.5	DL	?	0.58	39
Thallium	60	48	12	22/60	0.11	3.5	033TBB201	0 - 0.5	2.2	15	NA	NA
Vanadium	60	48	12	60/60	1.2	80.5	033TBB200	0 - 0.5	96	NA	NA	NA
Zinc	60	48	12	60/60	3.2	5410	TBBSB009	0 - 0.5	264	22	158	26

TABLE 5-2
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
DESCRIPTIVE SAMPLING DATA (CONTINUED)

Analyte	Total No. of Samples	No. of Surface Samples	No. of Sub-surface Samples	Freq. of Detect	Min Detect (mg/kg)	Max Detect (mg/kg)	Location of Max Detect	Depth of Max Detect (bgs)	Tidal Area Ambient (mg/kg)	No. Smp > Tidal Area Ambient	SF Bay Ambient (mg/kg)	No. Smp > SF Bay Ambient
Aquatic Habitat												
Aluminum	29	29	0	29/29	1890.00	23300.00	033TBB200	0 - 0.5	27,300	0	NA	NA
Antimony**	22	22	0	15/22	0.37	26.30	TBBSB015	0 - 0.5	2.2	13	NA	NA
Arsenic	29	29	0	27/29	3.20	106.00	TBBSB018	0 - 0.5	27	6	15.3	13
Barium	29	29	0	29/29	56.80	1140.00	TBBSB014	0 - 0.5	530	4	NA	NA
Beryllium	29	29	0	15/29	0.01	0.49	033TBB200	0 - 0.5	0.18	9	NA	NA
Cadmium	29	29	0	14/29	0.31	7.80	309CSPWSS	0 - 0.5	1.9	4	0.33	19
Chromium	29	29	0	29/29	0.89	2990.00	TBBSB015	0 - 0.5	82.1	3	112	2
Cobalt	29	29	0	26/29	4.30	27.80	TBBSB019	0 - 0.5	36	0	NA	NA
Copper	29	29	0	29/29	1.10	1980.00	TBBSB020	0 - 0.5	81	13	68.1	15
Lead	29	29	0	29/29	1.70	3280.00	TBBSB014	0 - 0.5	95	17	43.2	26
Manganese	29	29	0	29/29	0.69	2480.00	033TBB209	0 - 0.5	1500	6	NA	NA
Mercury	29	29	0	8/29	0.18	1.50	033TBB204	0 - 0.5	0.32	9	0.43	7
Molybdenum	29	29	0	28/29	0.10	301.00	TBBSB013	0 - 0.5	6.6	4	NA	NA
Nickel	29	29	0	29/29	0.89	126.00	TBBSB020	0 - 0.5	120	1	112	1
Selenium	29	29	0	18/29	0.47	11.50	TBBSB019	0 - 0.5	DL		0.64	25
Silver	29	29	0	14/29	0.13	2.80	TBBSB015	0 - 0.5	DL		0.58	17
Thallium	29	29	0	16/29	0.11	3.50	033TBB201	0 - 0.5	2.2	13	NA	NA
Vanadium	29	29	0	29/29	1.20	80.50	033TBB200	0 - 0.5	96	0	NA	NA
Zinc	29	29	0	29/29	3.20	4980.00	033TBB205	0 - 0.5	264	14	158	17

TABLE 5-2
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

DESCRIPTIVE SAMPLING DATA (CONTINUED)

Analyte	Total No. of Samples	No. of Surface Samples	No. of Sub-surface Samples	Freq. of Detect	Min Detect (mg/kg)	Max Detect (mg/kg)	Location of Max Detect	Depth of Max Detect (bgs)	Tidal Area Ambient (mg/kg)	No. Smp > Tidal Area Ambient	SF Bay Ambient (mg/kg)	No. Smp > SF Bay Ambient
land Transitional Plant Habitat												
Aluminum	42	30	12	42/42	3.00	19000.00	TBBSB001	2 - 2.5	27,300	0	NA	NA
Antimony***	34	27	7	20/42	0.37	84.20	TBBSB003	0 - 0.5	2.2	14	NA	NA
Arsenic	42	30	12	41/42	0.34	142.00	TBBSB003	0 - 0.5	27	10	15.3	12
Barium	42	30	12	42/42	5.60	4660.00	TBBSB001	0 - 0.5	530	7	NA	NA
Beryllium	42	30	12	25/42	0.01	0.60	TBBSB001	2 - 2.5	0.18	11	NA	NA
Cadmium	42	30	12	12/42	0.31	13.40	TBBSB010	0 - 0.5	1.9	5	0.33	14
Chromium	42	30	12	42/42	0.89	2990.00	TBBSB015	0 - 0.5	82.1	7	112	5
Cobalt	42	30	12	39/42	5.40	37.50	TBBSB004	0 - 0.5	36	2	NA	NA
Copper	42	30	12	37/42	1.10	12500.00	TBBSB010	0 - 0.5	81	14	68.1	15
Lead	42	30	12	42/42	1.70	7680.00	TBBSB003	0 - 0.5	95	23	43.2	26
Manganese	42	30	12	42/42	0.69	1940.00	309SB05	0 - 0.5	1500	3	NA	NA
Mercury	42	30	12	10/42	0.18	26.40	TBBSB003	0 - 0.5	0.32	8	0.43	6
Molybdenum	42	30	12	23/42	0.08	301.00	TBBSB013	0 - 0.5	6.6	6	NA	NA
Nickel	42	30	12	42/42	0.89	262.00	TBBSB003	0 - 0.5	120	4	112	4
Selenium	42	30	12	20/42	0.17	12.00	TBBSB017	0 - 0.5	DL		0.64	20
Silver	42	30	12	9/42	0.13	6.70	033TBB206	0 - 0.5	DL		0.58	21
Thallium	42	30	12	10/42	0.11	2.10	TBBSB105	0 - 0.5	2.2	3	NA	NA
Vanadium	42	30	12	42/42	1.20	62.20	TBBSB105	0 - 0.5	96	0	NA	NA
Zinc	42	30	12	42/42	3.20	5410.00	TBBSB009	0 - 0.5	264	16	158	17

Notes:
* - Whole Site - 15 samples were rejected or antimony not analyzed
** - Aquatic habitat - 8 samples were rejected or antimony not analyzed
*** - Wetland and Upland Transitional Habitat - 8 samples were rejected or antimony not analyzed
a - When samples were collected in both surface and subsurface at the same location, subsequent calculations used the maximum concentration
bgs - below ground surface
mg/kg - milligrams per kilogram

TABLE 7-1

NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD
TIDAL AREA AMBIENT

Analyte	Concord Tidal Area Ambient 99th Percentile[a] (mg/kg)
Aluminum	27,300
Antimony	2.2
Arsenic	27
Barium	530
Beryllium	0.18
Cadmium	1.90
Chromium	82.1
Cobalt	36
Copper	81
Lead	95
Manganese	1,500
Mercury	0.32
Molybdenum	6.6
Nickel	120
Selenium	NA
Silver	NA
Thallium	2.2
Vanadium	96
Zinc	264

Notes:
mg/kg milligram per kilogram
UCL Upper confidence limit of the mean
a See Appendix E

TABLE 7-2

EXPOSURE POINT CONCENTRATIONS FOR SOIL AND SEDIMENT COPCs
AREA WITHIN THE 400 MG/KG LEAD ISOPLETH (AREA A)
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS SEAL BEACH DETACHMENT CONCORD

			Concentration (mg/kg)						
Chemical of Potential Concern	**Detection Frequency**	**Type of Distribution**	**Miminum SQL**	**Maximum SQL**	**Minimum Detected**	**Maximum Detected**	**Mean[a]**	**UCL_{95}[b]**	**RME[d]**
Metal									
Antimony	15/16	Lognormal	6.2	6.2	0.39	84.2	13.3	40.5	40.5
Arsenic	16/16	Lognormal	NL	NL	0.34	142	46.7	282	142
Barium	16/16	Lognormal	NL	NL	5.6	4,660	716	3,370	3,370
Beryllium	4/16	Lognormal	0.01	0.18	0.020	0.31	0.076	0.30	0.30
Cadmium	6/16	Lognormal	0.05	0.68	1.6	13.4	2.23	67.5	13.4
Chromium	16/16	Lognormal	NL	NL	17.7	2,990	261	379	379
Cobalt	14/16	Lognormal	11	12	9.6	37.5	18.9	26.0	26.0
Copper	16/16	Lognormal	NL	NL	71.7	12,500	1,770	4,610	4,610
Iron	16/16	Normal	NL	NL	8,500	378,000	179,000	230,000	230,000
Lead	16/16	Lognormal	NL	NL	486	7,680	2,110	3,470	3,470
Manganese	16/16	Lognormal	NL	NL	321	1,660	1,010	1,280	1,280
Mercury	8/16	Lognormal	0.05	0.84	0.18	26.4	2.1	10.1	10.1
Molybdenum	15/16	Lognormal	0.58	0.58	0.67	301	24.2	60.4	60.4
Nickel	16/16	Lognormal	NL	NL	21.9	262	105	153	153
Selenium	12/16	Normal	0.2	8.4	1.1	12.0	4.8	6.6	6.6
Silver	7/16	Lognormal	0.9	11.4	1.1	6.7	2.3	4.2	4.2
Thallium	2/16	Not Tested	0.24	11.2	0.14	1.6	1.0	2.4	2.4
Tin	1/1	Not Tested	NL	NL	1,700	1,700	1,700	1,700	1,700
Zinc	16/16	Lognormal	NL	NL	196	5,410	2,140	4,160	4,160
Semivolatile Organic Compound									
Benzo(a)anthracene	1/6	Not Tested	0.35	0.58	0.5	0.5	0.3	0.4	0.4

TABLE 7-2 (Continued)

EXPOSURE POINT CONCENTRATIONS FOR SOIL AND SEDIMENT COPCs
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS SEAL BEACH DETACHMENT CONCORD
400 MG/KG LEAD ISOPLETH (AREA A)

Chemical of Potential Concern	Detection Frequency	Type of Distribution	Concentration (mg/kg)						
			Mimimum SQL	Maximum SQL	Minimum Detected	Maximum Detected	Mean[a]	UCL_{95}[b]	RME[d]
Benzo(a)pyrene	3/6	Not Tested	0.35	0.46	0.07	0.6	0.2	0.6	0.6
Benzo(b)fluoranthene	5/6	Lognormal	0.46	0.46	0.06	2	0.4	5	2
Benzo(g,h,i)perylene	2/6	Not Tested	0.35	0.58	0.1	0.4	0.2	0.4	0.4
Benzo(k)fluoranthene	1/6	Not Tested	0.35	2.2	0.05	0.05	0.3	2	0.05
Chrysene	5/6	Lognormal	0.46	0.46	0.05	1	0.3	5	1
Fluoranthene	5/6	Lognormal	0.46	0.46	0.05	0.6	0.2	1	0.6
Indeno(1,2,3-cd)pyrene	2/6	Not Tested	0.35	0.58	0.08	0.4	0.2	0.4	0.4
Naphthalene	1/6	Not Tested	0.35	0.58	0.05	0.05	0.2	0.5	0.05
Phenanthrene	2/6	Not Tested	0.35	0.58	0.06	0.4	0.2	0.5	0.4
Phenol	1/6	Not Tested	0.35	0.58	0.4	0.4	0.3	0.4	0.4
Pyrene	5/6	Lognormal	0.46	0.46	0.08	2	0.4	3	2

Notes

a The value presented is the arithmetic mean, calculated using distribution-dependent formulas. Substitute values of one-half the SQL are used for all analytical results reported as not detected.

b The value presented is the UCL95, calculated using distribution-dependent formulas. Substitute values of one-half the SQL are used for all analytical results reported as not detected.

c The value presented is the lesser of the maximum detected concentration and the arithmetic mean.

d The value presented is the lesser of the maximum detected concentration and the UCL95.

COPC Chemical of potential concern
mg/kg Milligrams per kilogram
NL Not listed (the analyte was detected in all samples)
RME Reasonable maximum exposure
SQL Sample quantitation limit
UCL95 95 percent upper confidence limit on the arithmetic mean

TABLE 7-3

EXPOSURE POINT CONCENTRATIONS FOR SOIL AND SEDIMENT COPCs
AREA OUTSIDE THE 400 MG/KG LEAD ISOPLETH (AREA B)
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS SEAL BEACH DETACHMENT CONCORD

Chemical of Potential Concern	Detection Frequency	Type of Distribution	Concentration (mg/kg)							
			Minimum SQL	Maximum SQL	Minimum Detected	Maximum Detected	Mean[a]	UCL_{95}[b]	CTE[c]	RME[d]
Metal										
Antimony	18/41	Lognormal	0.32	5.6	0.28	2.1	0.80	1.1	0.80	1.1
Arsenic	39/41	Lognormal	3.9	5.0	2.0	26.8	7.7	9.7	7.7	9.7
Barium	41/41	Lognormal	NL	NL	56.8	404	171	198	171	198
Beryllium	30/41	Lognormal	0.01	0.17	0.01	0.60	0.25	0.62	0.25	0.60
Cadmium	14/41	Lognormal	0.05	0.48	0.31	3.4	0.40	0.81	0.40	0.81
Chromium	41/41	Lognormal	NL	NL	0.89	148	27.4	35.9	27.4	35.9
Copper	36/41	Lognormal	11.8	12.9	1.1	199	39.0	61.8	39.0	61.8
Iron	41/41	Lognormal	NL	NL	63.2	88,800	19,500	36,300	19,500	36,300
Lead	41/41	Lognormal	NL	NL	1.7	378	88.3	210	88.3	210
Manganese	41/41	Lognormal	NL	NL	0.69	2,480	647	1,570	647	1,570
Mercury	3/41	Not Tested	0.04	0.75	0.25	1.5	0.13	0.16	0.13	0.16
Molybdenum	23/41	Lognormal	0.15	0.74	0.08	8.0	1.2	2.3	1.2	2.3
Selenium	16/41	Lognormal	0.17	7.6	0.17	6.9	1.1	1.5	1.1	1.5
Silver	7/41	Normal	0.08	3.4	0.13	1.5	0.56	0.68	0.56	0.68
Thallium	17/36	Lognormal	0.24	10.2	0.11	3.5	1.3	2.7	1.3	2.7
Zinc	41/41	Lognormal	NL	NL	3.2	4,980	235	275	235	275
Semivolatile Organic Compound										
Benzo(a)anthracene	1/18	Not Tested	0.37	0.61	0.07	0.07	0.2	0.2	0.07	0.07

TABLE 7-3

EXPOSURE POINT CONCENTRATIONS FOR SOIL AND SEDIMENT COPCs
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS SEAL BEACH DETACHMENT CONCORD
AREA OUTSIDE 400 MG/KG LEAD ISOPLETH (AREA B)

Chemical of Potential Concern	Detection Frequency	Type of Distribution	Concentration (mg/kg)							
			Miminum SQL	Maximum SQL	Minimum Detected	Maximum Detected	Mean[a]	UCL_{95}[b]	CTE[c]	RME[d]
Benzo(a)pyrene	1/18	Not Tested	0.37	0.61	0.09	0.09	0.2	0.2	0.09	0.09
Benzo(b)fluoranthene	4/18	Lognormal	0.39	0.61	0.06	0.2	0.2	0.2	0.2	0.2
Benzo(k)fluoranthene	1/18	Not Tested	0.37	0.61	0.04	0.04	0.2	0.3	0.04	0.04
Chrysene	4/18	Lognormal	0.39	0.61	0.05	0.1	0.2	0.3	0.1	0.1
Fluoranthene	4/18	Lognormal	0.39	0.61	0.05	0.2	0.2	0.2	0.2	0.2
Phenanthrene	1/18	Not Tested	0.37	0.61	0.07	0.07	0.2	0.2	0.07	0.07
Phenol	3/18	Not Tested	0.36	0.43	0.5	0.8	0.3	0.3	0.3	0.3
Pyrene	4/18	Lognormal	0.39	0.61	0.04	0.3	0.2	0.3	0.2	0.3

Notes

a The value presented is the arithmetic mean, calculated using distribution-dependent formulas. Substitute values of one-half the SQL are used for all analytical results reported as not detected.

b The value presented is the UCL_{95}, calculated using distribution-dependent formulas. Substitute values of one-half the SQL are used for all analytical results reported as not detected.

c The value presented is the lesser of the maximum detected concentration and the arithmetic mean.

d The value presented is the lesser of the maximum detected concentration and the UCL_{95}.

COPC Chemical of potential concern
CTE Central tendency exposure
mg/kg Milligrams per kilogram
NL Not listed (the analyte was detected in all samples)
RME Reasonable maximum exposure
SQL Sample quantitation limit
UCL_{95} 95 percent upper confidence limit on the arithmetic mean

TABLE 7-4
CANCER RISK AND HAZARD INDEX FROM POTENTIAL RESIDENTIAL EXPOSURE TO COPCS IN SOIL
AREA WITHIN THE 400 MG/KG LEAD ISOPLETH (AREA A)
TAYLOR BOULEVARD BRIDGE DEBRIS AREA, NAVAL WEAPONS SEAL BEACH DETACHMENTCONCORD

Chemical of Potential Concern	RME Exposure Point Concentration (mg/kg)	EPA Region 9 Residential PRG (mg/kg)		RME Cancer Risk	RME Hazard Quotient
		Cancer	Noncancer		
Metal					
Antimony	40.5	--	31	--	1.3
Arsenic	142	0.39	22	3.6E-04	6.5
Barium	3,370	--	5,400	--	0.62
Beryllium	0.30	1,100	150	2.7E-10	< 0.01
Cadmium[a]	13.4	9	37	1.5E-06	0.36
Chromium[b]	379	210	100,000	1.8E-06	< 0.01
Cobalt	26.0	--	4,700	--	< 0.01
Copper	4,610	--	2,900	--	1.6
Iron	230,000	--	23,000	--	10
Manganese	1,280	--	1,800	--	0.71
Mercury	10.1	--	23	--	0.44
Molybdenum	60.4	--	390	--	0.15
Nickel[a]	153	150	1,600	1.0E-06	0.10
Selenium	6.6	--	390	--	0.02
Silver	4.2	--	390	--	0.01
Thallium	2.4	--	5.5	--	0.44
Tin	1,700	--	--	--	--
Zinc	4,160	--	23,000	--	0.18
Semivolatile Organic Compound					
Benzo(a)anthracene	0.4	0.62	--	6.5E-07	--
Benzo(a)pyrene	0.6	0.062	--	9.7E-06	--
Benzo(b)fluoranthene	2	0.62	--	3.2E-06	--
Benzo(g,h,i)perylene[c]	0.4	--	22,000	--	< 0.01
Benzo(k)fluoranthene[a]	0.05	0.61	--	8.2E-08	--
Chrysene[a]	1	6.1	--	1.6E-07	--
Fluoranthene	0.6	--	2,300	--	< 0.01

TABLE 7-4
CANCER RISK AND HAZARD INDEX FROM POTENTIAL RESIDENTIAL EXPOSURE TO COPCS IN SOIL
AREA WITHIN THE 400 MG/KG LEAD ISOPLETH (AREA A)
TAYLOR BOULEVARD BRIDGE DEBRIS AREA, NAVAL WEAPONS SEAL BEACH DETACHMENTCONCORD

Chemical of Potential Concern	RME Exposure Point Concentration (mg/kg)	EPA Region 9 Residential PRG (mg/kg)		RME Cancer Risk	RME Hazard Quotient
		Cancer	Noncancer		
Indeno(1,2,3-cd)pyrene	0.4	0.62	--	6.5E-07	--
Naphthalene	0.05	--	56	--	< 0.01
Phenanthrene[d]	0.4	--	2,300	--	< 0.01
Phenol	0.4	--	37,000	--	< 0.01
Pyrene	2	--	2,300	--	< 0.01
			TOTAL:	**4E-04**	**22**

Notes:

a Cal-modified PRG (EPA 1999)

b The cancer PRG for chromium assumes a 1 to 6 ratio of hexavalent chromium to trivalent chromium. The noncancer PRG is not a risk-based number, but rather the 'max' concentration listed in the PRG document. This PRG value is assigned to all chemicals for which the risk-based PRG is greater than 100,000.

c A PRG is not available for benzo(g,h,i)perylene; the PRG for anthracene was used as a surrogate value.

d A PRG is not available for phenanthrene; the PRG for pyrene was used as a surrogate value.

-- Not available or applicable

mg/kg Milligrams per kilogram

PRG U.S. Environmental Protection Agency Region 9 preliminary remediation goal (EPA 1999)

RME Reasonable maximum exposure

TABLE 7-5
CANCER RISK AND HAZARD INDEX FROM POTENTIAL RESIDENTIAL EXPOSURE TO COPCS IN SOIL
AREA OUTSIDE THE 400 MG/KG LEAD ISOPLETH (AREA B)
TAYLOR BOULEVARD BRIDGE DEBRIS AREA, NAVAL WEAPONS SEAL BEACH DETACHMENT CONCORD

Chemical of Potential Concern	RME Exposure Point Concentration (mg/kg)	EPA Region 9 Residential PRG (mg/kg)		RME Cancer Risk	RME Hazard Quotient
		Cancer	Noncancer		
Metal					
Antimony	1.1	--	31	--	0.035
Arsenic	9.7	0.39	22	2.5E-05	0.44
Barium	198	--	5,400	--	0.037
Beryllium	0.60	1,100	150	5.5E-10	< 0.01
Cadmium[a]	0.81	9	37	9.0E-08	0.022
Chromium[b]	35.9	210	100,000	1.7E-07	< 0.01
Copper	61.8	--	2,900	--	0.021
Iron	36,300	--	23,000	--	1.6
Manganese	1,570	--	1,800	--	0.87
Mercury	0.16	--	23	--	< 0.01
Molybdenum	2.3	--	390	--	< 0.01
Selenium	1.5	--	390	--	< 0.01
Silver	0.68	--	390	--	< 0.01
Thallium	2.7	--	5.5	--	0.49
Zinc	275	--	23,000	--	0.012
Semivolatile Organic Compound					
Benzo(a)anthracene	0.07	0.62	--	1.1E-07	--
Benzo(a)pyrene	0.09	0.062	--	1.5E-06	--
Benzo(b)fluoranthene	0.2	0.62	--	3.2E-07	--
Benzo(k)fluoranthene[a]	0.04	0.61	--	6.6E-08	--
Chrysene[a]	0.1	6.1	--	1.6E-08	--
Fluoranthene	0.2	--	2,300	--	< 0.01
Phenanthrene[c]	0.07	--	2,300	--	< 0.01
Phenol	0.3	--	37,000	--	< 0.01
Pyrene	0.3	--	2,300	--	< 0.01
			TOTAL:	**3E-05**	**4**

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TABLE 7-5
CANCER RISK AND HAZARD INDEX FROM POTENTIAL RESIDENTIAL EXPOSURE TO COPCS IN SOIL
AREA OUTSIDE THE 400 MG/KG LEAD ISOPLETH (AREA B)
TAYLOR BOULEVARD BRIDGE DEBRIS AREA, NAVAL WEAPONS SEAL BEACH DETACHMENT CONCORD

Notes:

a	Cal-modified PRG (EPA 1999)
b	The cancer PRG for chromium assumes a 1 to 6 ratio of hexavalent chromium to trivalent chromium. The noncancer PRG is not a risk-based number, but rather the 'max' concentration listed in the PRG document. This PRG value is assigned to all chemicals for which the risk-based PRG is greater than 100,000 mg/kg.
c	A PRG is not available for phenanthrene; the PRG for pyrene was used as a surrogate value.
--	Not available or applicable
mg/kg	Milligrams per kilogram
PRG	U.S. Environmental Protection Agency Region 9 preliminary remediation goal (EPA 1999)
RME	Reasonable maximum exposure

TABLE 8-1
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
PROBLEM FORMULATION TABLE

Receptor Class and Specific Receptors	Assessment Endpoint	Risk Questions	Surrogate Species or Community	Measurement Endpoints	Uncertainties	Weight of evidence approach (Decision criteria)
1° PRODUCERS Wetland and upland transitional plants	Protection and maintenance of populations of wetland and upland transitional plants. Sufficient rates of survival, growth, and germination to sustain populations of wetland and upland plants	Are concentrations of chemicals in sediment present at levels above the Oak Ridge National Laboratory (ORNL) plant benchmarks?	Various plant species used in studies upon which ORNL benchmarks were based	(1) Chemical characterization of sediment and comparison to ORNL toxicity benchmarks for plants	(1) Difference between site-specific bioavailability and form of chemical, and that used to derive benchmark (2) Difference in species composition of site-specific plants and those used in development of benchmarks	Chemical concentrations that significantly exceed available literature-derived effects levels will indicate risk to wetland and upland transitional plants at the site. Potential adverse effects from several chemicals or at numerous locations will indicate risk to wetland and upland transitional plant populations
1° CONSUMERS Benthic macroinvertebrates such as amphipods, isopods, polychaetes, oligochaetes, bivalves, gastropods, and decapods	Protection of populations of benthic invertebrates Sufficient rates of survival and growth to sustain populations of benthic invertebrates	Is reburial and survival of amphipods used in bulk sediment toxicity tests lower than the Regional Water Quality Control Board reference envelope?	Amphipods (*Eohaustorius estuarinus*) Invertebrate species used in the development of the ER-Ls and ER-Ms.	(1) Chemical characterization of sediment and comparison to ER-Ls and ER-Ms at which effects on populations are expected (2) Biological testing - whole sediment bioassay using the amphipod *Eohaustorius estuarius* (statistically significant reduction in survival and reburial)	(1) Limited sample locations tested using bioassays (2) Chemicals may be introduced into site from tidal sources (3) Species vary significantly in their sensitivities to contaminants (4) Limitations in data in the literature to assess potential effects from some chemicals present (5) Actual conditions of exposure at these sites may not be represented during toxicity testing. (6) Ambient levels of chemicals often exceed ER-Ls and ER-Ms (e.g. nickel)	Chemical concentrations that significantly exceed ER-Ms will indicate risk to aquatic invertebrates at the site Biologically and statistically significant reduction in survival or reburial in amphipod bioassay will indicate risk to invertebrate receptors
1° CONSUMERS Salt marsh harvest mouse (endangered species; federally protected) *	Protection of individual salt marsh harvest mice Sufficient rates of survival, growth, and reproduction to sustain individual herbivorous mammals	Do site-specific modeled doses to representative species, such as the salt marsh harvest mouse exceed the Navy high and low TRVs for specific endpoints identified?	Laboratory rodents used in toxicological studies upon which TRVs are based.	Food-chain modeling for the salt marsh harvest mouse, using measured concentrations of chemicals in pickleweed tissues and incidentally ingested soil; comparisons with TRVs at which effects on individuals expected	(1) Bioavailability and form of site contaminants compared with studies used as the basis for TRVs. (2) TRVs not available for all chemicals; a qualitative review will be conducted for chemicals for which TRVs are unavailable (3) Species sensitivities differ; laboratory test animal in TRV study may not be suitable surrogate for wildlife receptor of concern	A hazard quotient approach will be used to evaluate risk (HQ=dose/TRV). Chemicals for which site-specific doses exceed the high TRV that represents the mid-range of effects level will carry the strongest weight and are the best evidence of risk to higher level receptors.
2° CONSUMERS Shorebirds (Black-necked Stilt and others)	Protection of populations of shorebirds Sufficient rates of survival, growth, and reproduction to sustain individual shorebirds/wading birds	Do site-specific modeled doses to representative species, such as the Black necked Stilt, exceed the Navy high and low TRVs for specific endpoints identified?	Laboratory animals, such as chickens, used in toxicological studies upon which the TRVs were based	Food-chain modeling to Black necked stilt, using measured concentrations of chemicals in prey and sediment; comparison of site-specific dose to literature-derived TRVs	1. Doses calculated based on concentrations in amphipod tissue; actual diets may differ 2. Bioavailability of site contaminants compared to those in studies upon which TRVs were based 3. Species sensitivity varies; laboratory test animal may not be suitable surrogate for wildlife species	A hazard quotient approach will be used to evaluate risk (HQ=dose/TRV). Chemicals for which site-specific doses exceed the high TRV that represents the mid-range of effects level will carry the strongest weight and are the best evidence of risk to higher level receptors.

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TABLE 8-2
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
RATIONALE FOR SELECTION OF ASSESSMENT ENDPOINTS

Assessment Endpoints	Rationale
Protection and maintenance of populations of wetland and upland transitional plants Sufficient rates of survival, growth, and germination to sustain populations of wetland and upland plants	- Provides habitat structure and cover - Food and habitat for salt marsh harvest mouse - Exposure via sediment and surface water
Protection of populations of benthic invertebrates Sufficient rates of survival and growth to sustain populations of benthic invertebrates	- Prey of shorebirds - Sensitive to contaminated sediments - Exposure via sediment and surface water
Protection of populations of waterfowl (Mallard) Sufficient rates of survival, growth, and reproduction to sustain populations of avian aquatic omnivores	- Protected under Migratory Bird Treaty Act (MBTA) - Exposure via prey, surface water, and sediment
Protection of populations of shorebirds (Black-necked stilt) Sufficient rates of survival, growth, and reproduction to sustain individual shorebirds (black necked stilt)	- Prey of raptors - Exposure via prey, sediment, and surface water
Protection of individual salt marsh harvest mice Sufficient rates of survival, growth, and reproduction to sustain individual herbivorous mammals	- Special-status species - Prey of top predators - Exposure via prey, soil, and surface water

TABLE 8-3
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
NATURAL HISTORY OF ASSESSMENT ENDPOINT SPECIES

Species	Status	CA Native	Suisun Bay Residency	Home Range	Exposure Route	Feeding Guild
Wetland and Upland Transitional Plants	None	Yes	All year	N/A	Soil, Sediment, Surface water	Primary Producer
Benthic Invertebrate Community	None	Yes	All year	Soft bottom estuarine and marine habitats	Sediment, Surface water, Prey	Detritivores, omnivores, carnivores
Mallard Duck *Anas platyrhynchos*	Harvested	Yes	All year	Breeding range: avg. 225-468 hectare (ha)	Sediment, Surface water, Prey	Omnivore 90% plant material, animal foods important during breeding
Black-necked stilt *Himantopus mexicanus*	None	Yes	All year	Foraging area: generally located less than 1 kilometer from nest	Sediment, Surface water, Prey	Carnivore insects, crustaceans, mollusks and other aquatic invertebrates, and some small fish
Salt Marsh Harvest Mouse *Reithrodontomys raviventris halicoetes*	FE, CE	Yes	All year	Avgerage 2,133 $meter^2$	Sediment, Soil, Surface water, Prey	Herbivore Leaves, stems, seeds

TABLE 8-3 (CONTINUED)

NATURAL HISTORIES FOR REPRESENTATIVE SPECIES AT THE TBB DISPOSAL SITE

Table Notes:

Status

Species of special conservation status, as registered in the California Department of Fish and Game's Natural Diversity Data Base, are indicated by the following codes.

CE	California Endangered
SSC	California Department of Fish and Game (CDFG) Species of Special Concern
SE	State Endangered Species
ST	State Threatened Species
SC	Candidate for listing as Endangered Species by state
FE	Federal Endangered Species
AB	Species listed on the Audubon Blue List of birds designated by the National Audubon Society as experiencing a population decline
None	Species has no special status

Native

Yes	Species is native to California.	No	Species is not native to California.

Exposure Route

The exposure route column reflects the primary routes of exposure to contaminants for the species.

Feeding Guild

Carnivore	Eats primarily animals.	Omnivore	Eats a combination of animals and plants.
Herbivore	Eats primarily plants.	Detritivore	Eats primarily detritus.
Primary Producer	Photosynthesizes.		

TABLE 8-4
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
RELATIONSHIP BETWEEN THE ASSESSMENT ENDPOINTS AND
MEASUREMENT ENDPOINTS

ASSSESSMENT ENDPOINTS	MEASUREMENT ENDPOINTS
Protection and maintenance of populations of wetland and upland transitional plants Sufficient rates of survival, growth, and germination to sustain populations of wetland and upland plants	Bulk sediment chemical characterization and comparison to toxicological benchmarks
Protection of populations of benthic invertebrates Sufficient rates of survival and growth to sustain populations of benthic invertebrates	Bulk sediment chemical characterization and comparison to guidance values and amphipod toxicity test (10-day whole sediment bioassay using the estuarine amphipods *Eohaustorius estuarius*).
Protection of populations of waterfowl (Mallard) Sufficient rates of survival, growth, and reproduction to sustain populations of avian aquatic omnivores	Food chain modeling using measured tissue concentrations in invertebrate tissue.
Protection of populations of shorebirds (Black-necked stilt) Sufficient rates of survival, growth, and reproduction to sustain individual shorebirds (black necked stilt)	Food chain modeling using measured tissue concentrations in invertebrate tissue.
Protection of individual salt marsh harvest mice Sufficient rates of survival, growth, and reproduction to sustain individual herbivorous mammals	Food chain modeling using measured tissue concentrations in pickleweed.

TABLE 8-5
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
LINES OF EVIDENCE

Assessment Endpoint	Line of Evidence	Data set	Steps	Decision Point
Protection and maintenance of populations of wetland and upland transitional plants (Sufficient rates of survival, growth, and germination to sustain populations of wetland and upland plants)	Toxicity - compare to ORNL benchmarks for plants (growth and yield)	Wetland & upland transitional sediment chemistry (n = 30, includes shoreline data). For locations where surface and subsurface data are available, use the maximum concentration	1. Calculate 95th percent UCL 2. Compare 95th percent UCL to Tidal ambient, RWQCB ambient, and ORNL benchmark 3. If 95th UCL exceeds most conservative ambient and ORNL benchmark, then chemical is a plant COPEC. If less than conservative ambient or ORNL, not a COPEC 4. To evaluate spatial extent, calculate HQ for each point (HQ = metal conc / ORNL (use ½ detection limit for nondetects))	Screening process will determine plant COPECs HQs to evaluate spatial distribution of contaminants
	Bioaccumulation (calculate BAF)	Collocated sediment and pickleweed samples (n = 3)	1. For each COPEC, convert pickleweed residue to dry weight (wet wt. concentration / % solid) 2. Calculate BAF (tissue /sediment) (use ½ the detection limit for nondetects)	This is a qualitative evaluation; no benchmarks available.
	Toxicity - literature review of toxicity to plants	Review of the primary literature for COPECs with high BAFs and high magnitude and spatial extent. Focus on wetland plants.		Qualitative evaluation of potential toxicity

TABLE 8-5
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
LINES OF EVIDENCE

Assessment Endpoint	Line of Evidence	Data set	Steps	Decision Point
Protection of populations of benthic invertebrates (sufficient rates of survival and growth to sustain populations of benthic invertebrates)	Toxicity - comparison to a ER-L and ER-M screening values for benthic invertebrates	1. Aquatic sediment samples (n = 29, includes shoreline data).	1. Calculate 95th percent 2. Compare 95th percent UCL to Tidal ambient, RWQCB ambient, and ER-L 3. If 95th UCL exceeds most conservative ambient and ER-L, it is an invertebrate COPEC. If less than conservative ambient or ER-L, it is not an invertebrate COPEC 4. To evaluate spatial extent of contamination, calculate mean ER-M quotients for each COPEC and sampling location a. HQ = metal conc / ER-M (use ½ detection limit for nondetects) b. Mean ER-M HQ (per location) = Sum HQ / Number of HQs	Screening process will determine invertebrate COPEC. HQs to evaluate spatial distribution
	Bioaccumulation (calculate BAF)	Collocated sediment and amphipod data (n = 3)	1. For each sample, convert amphipod residue to dry weight (wet wt. concentration / % solid) 2. Calculate BAF (tissue /soil).	Qualitative evaluation; no benchmarks available.
	Toxicity – survival and reburial of *Eohaustorius estuarius*	*Eohaustorius* bioassays (n = 3)	Compare site survival to RWQCB reference site survival and site reburial to laboratory control	H_o: Survival > reference envelope (68%) H_o: Reburial > 90% laboratory control
	Factors affecting bioavailability	Sediment samples (n = 3). Evaluate SEM/AVS, grain size, pH, and TOC	1. Calculate SEM/AVS ratio a. Convert SEM metals to umoles b. Convert AVS to umoles c. SEM/AVS 2. For each location, determine %fine grain sediment (<62 μm) 3. TOC	SEM/AVS < 1.0 suggests metal is not bioavailable. Metals may become more bioavailable at lower pH Grain size important variable, as smaller particles carry greater contaminant loads TOC increases with grain size.

TABLE 8-5
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
LINES OF EVIDENCE

Assessment Endpoint	Line of Evidence	Data set	Steps	Decision Point
Birds: Protection of populations of waterfowl and shorebirds [(Mallard and Black-necked stilt). Sufficient rates of survival, growth, and reproduction to sustain populations of avian aquatic receptors] **Mammals:** Protection of individual salt marsh harvest mice (sufficient rates of survival, growth, and reproduction to sustain individual herbivorous mammals)	Food-chain modeling	Sediment data. For birds data set includes aquatic and 'wetland and upland transitional' habitats (n = 48; includes shoreline). For the salt marsh harvest mouse, data set includes only samples collected from the 'wetland and upland transitional' habitat (n=30; includes shoreline data).	**<u>Birds</u>** 1. Calculate 95th UCL for birds (n = 48) 2. Compare 95th UCL for birds to ambient. If exceeds most conservative of Tidal Area ambient or RWQCB ambient, then bird COPEC. 3. Calculate a typical dose for avian receptors (Mallard and Black-necked stilt). In dose equation, use maximum prey concentration for each COPEC and 95 percent UCL sediment concentration. 4. Calculate HQs). HQ = dose / TRV. **<u>Salt Marsh Harvest Mouse</u>** 1. Calculate 95th UCL for salt march harvest mouse (n = 30) 2. Compare 95th UCL for salt march harvest mouse to ambient. If 95th UCL exceeds most conservative of tidal or RWQCB ambient, then salt march harvest mouse COPEC. 3. Using the maximum pickleweed BAF, calculate location specific tissue concentrations (BAF * sediment concentration) 4. Calculate high and low point doses using site sediment and estimated tissue 5. Calculate HQs ($HQ_{(High\ dose/low\ TRV)}$, $HQ_{(Low\ dose/high\ TRV)}$, and $HQ_{(High\ dose/high\ TRV)}$. HQ = dose / TRV.	$HQ_{(High\ dose/low\ TRV)} > 1$ indicates significant risk $HQ_{(Low\ dose/high\ TRV)} < 1$ indicates little or no risk $HQ_{(High\ dose/high\ TRV)} > 1$ indicates probable risk (salt marsh harvest mouse only)

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TABLE 8-5
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
LINES OF EVIDENCE

Table Notes:

* - times
um - micrometers
BAF – Bioaccumulation factor
COEC – Chemical of Ecological Concern
COPEC – Chemical of potential ecological concern
ER- L – Effects range-low
ER-M – Effects range-median
H_o – Null hypothesis
HQ – Hazard quotient
ORNL – Oak Ridge National Laboratory
RWQCB – Regional Water Quality Control Board
SEM/AVS – Simultaneously extractable metals/acid volatile sulfide
TOC – Total organic chemistry
Toxicity reference value
umoles - micromoles
95 percent UCL – 95th percent upper confidence limit of the mean (one-tailed)

TABLE 8-6

TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD, INORGANIC CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR PLANTS

Analyte	Concord Tidal Area Ambient 99th % Percentile[a] (mg/kg)	RWQCB San Francisco Bay Sediment Ambient[b] (mg/kg)	ORNL Plant Toxicity Benchmark[c] (mg/kg)	TBB Sediment 95% UCL[d] (mg/kg)	Plant COPEC
Aluminum	27,300	NA	50.0	9830	N
Antimony	2.2	NA	5.0	13.2	Y
Arsenic	27	15.3	10.0	37.6	Y
Barium	530	NA	500	716	Y
Beryllium	0.18	NA	10.0	0.30	N
Cadmium	1.90	0.33	4.0	2.1	Y[e]
Chromium	82.1	112	20.0	308	Y
Cobalt	36	NA	100	16.6	N
Copper	81	68.1	50.0	1690	Y
Lead	95	43.2	50.0	1690	Y
Manganese	1,500	NA	0.30	925	N
Mercury	0.32	0.43	2.0	2.7	Y
Molybdenum	6.6	NA	30.0	28.4	N
Nickel	120	112	50.0	92.2	N
Selenium	NA	0.64	1.0	3.8	Y
Silver	NA	0.58	2.0	1.6	N
Thallium	2.2	NA	1.0	0.95	N
Vanadium	96	NA	2.0	36.0	N
Zinc	264	158	50.0	1660	Y

Notes:

mg/kg milligram per kilogram
COPEC Chemical of potential ecological concern
ORNL Oak Ridge National Laboratory
TBB Taylor Boulevard Bridge
UCL Upper confidence limit of the mean
N No
n = 30 Number of samples evaluated in the dataset
Y Yes

a See Appendix E

b RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May.

c Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997. 'Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revsion. Oak Ridge national laboratory, Oak Ridge, TN. 128 pp, ES/ER/TM-85.

d Nondetects were included in the calculation of the 95 percent UCL of the mean as one-half the detection limit. For locations where surface and subsurface data were available, the maximum concentration was used in the calculation of the 95 percent UCL of the mean. Plant dataset includes samples collected in the wetland and upland transitional habitat (n = 30; includes shoreline samples).

e Cadmium was not a COPEC based on the ambient and ORNL benchmark screening process, but was reclassified as a COPEC following a review of the metals that dropped out of the screening process.

TABLE 8-7
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
BENCHMARK METRICS FOR PLANT COPECS IN THE WETLAND AND UPLAND TRANSITIONAL PLANT HABITAT

COPEC	95th % UCL mg/kg	Wetland and Upland Transitional Habitat Range[d] mg/kg	Screening Values: Tidal Area Ambient[a] mg/kg	Screening Values: SF Bay Ambient[b] mg/kg	Screening Values: ORNL Toxicity Benchmark[c] mg/kg	Number Locations > Tidal Area Ambient (Percent)	Number Locations > SF Bay Ambient (Percent)	Number Locations > ORNL Plant Toxicity Benchmark (Percent)
Antimony	13.2	0.16-84.2	2.2	NA	5.0	13/27 (48)	NA	9/27 (33)
Arsenic	37.6	0.34-142	27.0	15.3	10.0	10/30 (33)	12/30 (40)	15/30 (50)
Barium	716	5.6-4,660	530	NA	500	7/30 (23)	NA	7/30 (23)
Chromium	308	0.89-2,990	82.1	112	20.0	7/30 (23)	5/30 (17)	26/30 (87)
Cadmium	2.1	0.025-13.4	1.9	0.33	4.0	5/30 (17)	11/30 (37)	3/30 (10)
Copper	1690	1.1-12,500	81.0	68.1	50.0	14/30 (47)	15/30 (50)	16/30 (53)
Lead	1690	1.7-7,680	95.0	43.2	50.0	23/30 (77)	25/30 (83)	25/30 (83)
Mercury	2.7	0.0050-26.4	0.32	0.43	2.0	8/30 (27)	6/30 (20)	3/30 (10)
Selenium	3.8	0.085-12.0	NA	0.64	1.0	NA	17/30 (57)	13/30 (43)
Zinc	1660	3.2-5,410	264	158.0	50.0	16/30 (53)	17/30 (57)	27/30 (90)

Notes:

mg/kg - milligrams per kilogram.

NA - Not applicable.

ORNL - Oak Ridge National Laboratory.

SF - San Francisco.

Numbers less than 10 are reported with two significant digits; numbers 10 and greater are reported with three significant digits.

[a] See Appendix E

[b]RWQCB. 1998. "Ambient Concentrations of Toxic chemicals in San Francisco Bay Sediments." Regional Water Quality Board, April.

[c]Efroymson, R.A., and others. 1997. "Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision." Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85.

[d]Concentrations used to compile the range included a substitution of one half of the detection limit for those chemicals that were not detected.

TABLE 8-8
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
HAZARD QUOTIENTS FOR COPECS FOR THE WETLAND AND UPLAND TRANSITIONAL PLANT HABITAT

Sample Location	Hazard Quotients (Sediment Concentration / ORNL Plant Toxicity Benchmark)									
	ANTIMONY	ARSENIC	BARIUM	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	SELENIUM	ZINC
309CSPWSS	**1.3**	**5.7**	**1.3**	**2.0**	**3.7**	**6.2**	**46.0**	0.090	**1.2**	**45.4**
309SB05	0.22	1.0	0.54	0.40	**1.6**	0.98	**3.2**	0.13	0.15	**5.7**
309SB106	0.074	0.77	0.35	0.078	**1.5**	0.43	**5.4**	0.0025	0.10	**1.4**
SB001	**1.1**	**5.8**	**9.3**	0.070	**6.8**	**12.2**	**51.2**	0.21	0.42	**81.8**
SB002	0.16	0.58	0.45	0.0063	**1.1**	0.51	0.69	0.015	0.30	**1.8**
SB003	**16.8**	**14.2**	**1.5**	**1.4**	**6.3**	**133**	**154**	**13.2**	0.30	**79.2**
SB004	**3.6**	**6.1**	**1.9**	0.70	**6.0**	**7.6**	**101**	**1.1**	9.0	**42.0**
SB005	0.034	0.86	0.49	0.0088	0.92	0.57	**4.0**	0.018	0.95	**2.5**
SB006	0.032	0.62	0.73	0.0075	**1.3**	0.40	**1.3**	0.013	0.87	**0.84**
SB007	0.035	0.61	0.40	0.0088	**1.1**	0.61	**3.7**	0.015	0.96	**2.4**
SB008	0.034	1.0	0.60	0.0088	**1.5**	0.78	**2.6**	0.015	0.39	**2.0**
SB009	**1.2**	**3.8**	0.78	0.83	**2.2**	**6.5**	**31.2**	**1.1**	**5.0**	**108**
SB010	**6.4**	**3.4**	0.60	**3.35**	**5.0**	**250**	**37.4**	0.35	**4.0**	**99.2**
SB011	0.038	**1.5**	0.42	0.010	**1.5**	1.0	**6.4**	0.015	1.0	**3.1**
SB012	**1.0**	0.66	0.81	0.0088	**1.4**	1.4	**15.0**	0.015	**1.1**	**3.9**
SB013	0.50	**2.0**	1.4	0.0090	**2.3**	**20.6**	**11.9**	0.20	**2.4**	**18.2**
SB014	**1.3**	**6.1**	**2.3**	0.0088	**3.9**	**5.4**	**65.6**	0.040	**7.8**	**33.2**
SB015	**5.3**	**5.8**	1.4	0.016	**150**	**14.5**	**20.4**	0.078	**6.8**	**30.8**
SB016	0.29	0.95	0.25	0.050	0.045	0.022	0.034	0.25	**2.0**	0.064
SB017	0.078	0.034	0.011	0.0068	**8.7**	**10.3**	**40.6**	0.035	**12.0**	**41.2**
SB018	**1.2**	**10.6**	0.39	0.012	**2.4**	**33.4**	**25.4**	0.055	**7.6**	**22.6**
SB019	0.76	**5.3**	0.37	0.0083	**4.3**	**8.6**	**32.8**	0.043	**11.5**	**14.7**
SB020	0.54	**2.3**	0.67	0.0075	**3.7**	**39.6**	**23.6**	0.32	**4.2**	**36.0**
SB105	0.092	0.048	0.41	0.010	0.74	0.74	0.50	0.015	0.60	**1.5**
SS206	0.24	0.77	0.43	0.40	**1.4**	**11.3**	**9.7**	0.013	0.10	**19.7**
SS210	NA	0.47	0.22	0.10	**1.2**	0.27	0.60	0.013	0.21	**1.4**
SS211	NA	0.31	0.25	0.0021	0.82	0.18	0.89	0.010	0.090	0.93
SS212	0.12	0.31	0.18	0.090	**1.6**	0.39	**1.1**	0.013	0.085	**2.1**
SS213	NA	0.74	0.24	0.17	**1.2**	1.1	**2.2**	0.13	0.085	**6.7**
SS214	0.088	0.81	0.18	0.095	**1.2**	0.35	**3.9**	0.014	0.17	**1.6**
Mean Hazard Quotient	**1.6**	**2.8**	0.96	0.33	**7.5**	**19.0**	**23.4**	0.58	**2.7**	**23.7**

Notes:
BOLD = HQ > 1
COPEC - Chemical of potential ecological concern
NA - Not analyzed.
HQ, Hazard quotient = Sample location COPEC concentration divided by ORNL plant toxicity benchmark for that COPEC.
HQs were calculated for plant COPECs: antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, and zinc.
Mean hazard quotient = Sum of hazard quotients across sample locations for one COPEC divided by the number of sample locations at which that COPEC was present.
Numbers less than 10 are reported with two significant digits; numbers 10 or greater are reported with three significant digits.

TABLE 8-9
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD, BIOACCUMULATION FACTORS FOR PICKLEWEED IN THE WETLAND AND UPLAND TRANSITIONAL PLANT HABITAT

	309CSPW		309CSPWSS		309SB05PW		309SB05		309SB106PW		309SB106		
Sample ID	Tissue (mg/kg wet wt)	Tissue (mg/kg dry wt)	Sediment (mg/kg dry wt)	BAF	Tissue (mg/kg wet wt)	Tissue (mg/kg dry wt)	Sediment (mg/kg dry wt)	BAF	Tissue (mg/kg wet wt)	Tissue (mg/kg dry wt)	Sediment (mg/kg dry wt)	BAF	Max BAF (mg/kg dry wt)
% Solid	11.1	NA	NA	NA	69.8	NA	NA	NA	15.1	NA	NA	NA	NA
Antimony	0.060	0.54	6.7	0.080	0.10	0.14	1.1	0.13	0.030	0.20	0.37	0.53	0.53
Arsenic	3.5	31.5	57.0	0.55	0.30	0.43	10.4	0.041	5.4	35.8	7.7	**4.6**	**4.6**
Barium	4.4	39.6	646	0.061	9.4	13.5	268	0.050	5.1	33.8	175	0.19	0.19
Cadmium	0.36	3.2	7.8	0.42	0.060	0.090	1.6	0.050	0.080	0.52	0.31	**1.7**	**1.7**
Chromium	0.79	7.1	73.4	0.10	1.9	2.7	32.5	0.084	0.90	5.9	29.4	0.20	0.20
Copper	5.0	45.0	311	0.14	9.1	13.0	49.0	0.27	3.5	23.2	21.7	**1.1**	**1.1**
Lead	0.42	3.8	2300	0.0016	1.9	2.7	162	0.017	0.29	1.9	268	0.0071	0.017
Mercury	0.010	0.090	0.18	0.50	0.020	0.029	0.26	0.11	0.010	0.066	0.0050	**13.2**	**13.1**
Selenium	0.50	4.5	1.2	**3.7**	0.050	0.072	0.30	0.24	0.049	0.32	0.10	**3.2**	**3.7**
Zinc	54.8	494	2270	0.22	28.4	40.7	284	0.14	15.0	99.3	71.2	**1.4**	**1.4**

Notes:
mg/kg wet wt - Milligrams per kilogram in wet weight.
mg/kg dry wt - Milligrams per kilogram in dry weight.
BAF - Bioaccumulation factor
NA - Not applicable
Bold = BAF > 1
BAF = tissue concentration (mg/kg dry wt) / sediment concentration (mg/kg dry weight).
BAFs calculated for plant chemicals of potential ecological concern (COPECs).
Chemicals not detected are reported as one half of the detection limit.
Numbers less than 10 are reported with two significant digits; numbers 10 or greater are reported with three significant digits.
Tissue concentration (mg/kg dry wt) = tissue concentration (mg/kg wet weight) / % solid/100).

TABLE 8-10
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
OVERVIEW OF RISK ASSESSMENT PROCESS FOR PLANTS

ASSESSMENT ENDPOINT: Protection and maintenance of populations of wetland and upland transitional plants (sufficient rates of survival, growth, and germination to sustain populations of wetland and upland plants)

SCREENING PROCESS	COPECS	HAZARD QUOTIENT (HQ) AND MEAN HQs	HQ RESULTS	COPEC PLANT LITERATURE REVIEW	COECs
• Calculate 95[th] percent UCL of the mean in wetland and upland transitional plant habitat. • Compare each metal 95[th] percent UCL to lower of ambient 99[th] percentile for Concord Tidal Area or ambient 95[th] percent UCL for San Francisco Bay metal concentrations. • Compare to ORNL plant toxicity benchmark (Efroynison, and others 1997). The metal was a COPEC if it exceeded the lower of the San Francisco Bay *or* Concord Tidal Area ambient concentrations *and* exceeded the ORNL plant toxicity benchmark. Cadmium was reclassified as a COPEC after reviewing metals that dropped out of the screening process.	Antimony Arsenic Barium Cadmium Chromium Copper Lead Mercury Selenium Zinc	• HQs (sample location metal concentration divided by ORNL plant toxicity benchmark) were calculated for COPECs at each sample location. • Mean HQs were calculated across sample locations for each COPEC at the habitat. See notes. **BIOACCUMULATION** • Collected three pickleweed tissue samples and three colocated sediment samples. • Calculated bioaccumulation factors (pickleweed tissue concentration divided by colocated sediment metal concentration) for COPECS. **BIOAVAILABILITY** • Three sediment samples used to calculate bioaccumulation factors were analyzed for pH and total organic carbon.	**Mean hazard quotients:** • Antimony, 1.6. • Arsenic, 2.8. • Barium, 0.96. • Cadmium, 0.33. • Chromium, 7.5. • Copper, 19.0. • Lead, 23.4. • Mercury, 0.58. • Selenium, 2.7. • Zinc, 23.7. **BIOACCUMULATION RESULTS** • Bioaccumulation factors > 1 suggest uptake and are listed below for COPECs: 309CSPWSS: Selenium, 3.7. 309SB05: None. 309SB106: Arsenic, 4.6. Cadmium, 1.7. Copper, 1.1. Mercury, 13.1. Selenium, 3.7. Zinc, 1.4. **BIOAVAILABILITY RESULTS** • pHs ranged from 7.56 to 8.22, and total organic carbon ranged from 43,600 to 102,000 mg/kg	**Antimony** (Sb). Probably immobile in soil and not available for uptake. Uptake occurs via airborne particulates deposited on foliage. **Arsenic** (As). Plant toxicity well characterized. Uptake and accumulation can occur. Toxicity occurs above threshold concentration. **Barium** (Ba). Very little relevant literature; available literature indicated minimal toxicity for BAFs < 100. **Cadmium** (Cd). Little terrestrial plant literature; accumulated but not biomagnified. **Chromium** (Cr). Little terrestrial plant literature; can be toxic. **Copper** (Cu). Plant toxicity well described. Can cause significant toxicity if available for uptake. **Lead** (Pb). Plant toxicity well described. Can cause significant toxicity if available for uptake **Mercury** (Hg). Plant toxicity poorly described. Uptake and availability in plants poorly understood. **Selenium** (Se). Plant toxicity well described. Uptake and accumulation occur. Toxic above threshold concentration. **Zinc** (Zn). Plant toxicity well described. Causes significant toxicity if available for uptake.	Arsenic Copper Selenium Zinc See text and Figure 8-5 for explanation of how COECs were identified.

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TABLE 8-10
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD, OVERVIEW OF RISK ASSESSMENT PROCESS FOR PLANTS

Table Notes
BAFs - Bioaccumulation factors
COPEC - Chemical of potential ecological concern
COEC - Chemical of ecological concern
ORNL - Oak Ridge National Laboratory
UCL - Upper confidence limit of the mean

Hazard quotients were calculated by dividing the COPEC concentration at that sample location by the ORNL plant toxicity benchmark for that COPEC.

Mean hazard quotients (mean HQ) were calculated by summing hazard quotients for one COPEC across sample locations and dividing that sum by the number of sample locations at which that COPEC was present.

Efroymson, R.A., and others. 1997. "Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision." Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER.TM-85.

RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." April.

TABLE 8-11
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD, INORGANIC CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN FOR BENTHIC INVERTEBRATES

Analyte	Concord Tidal Area Ambient 99th Percentile[a] (mg/kg)	RWQCB San Francisco Bay Sediment Ambient[b] (mg/kg)	ER-L[cd] (mg/kg)	ER-M[cd] (mg/kg)	TBB Sediment 95th % UCL[d] (mg/kg)[e]	Benthic Invertebrate COPEC
Aluminum	27,300	NA	NA	NA	11300	N
Antimony	2.2	NA	2.0[e]	25.0[e]	5.5	Y
Arsenic	27.0	15.3	8.2	70.0	29.2	Y
Barium	530	NA	NA	NA	320	N
Beryllium	0.18	NA	NA	NA	0.17	N
Cadmium	1.9	0.33	1.2	9.6	1.4	Y
Chromium	82.1	112	81.0	370	311	Y
Cobalt	36.0	NA	NA	NA	11.0	N
Copper	81.0	68.1	34.0	270	418	Y
Lead	95.0	43.2	46.7	218	747	Y
Manganese	1,500	NA	NA	NA	1170	N
Mercury	0.32	0.43	0.15	0.71	0.30	Y[f]
Molybdenum	6.6	NA	NA	NA	29.1	Y
Nickel	120	112	20.9	51.6	54.8	N
Selenium	NA	0.64	0.70[e]	1.4[e]	3.7	Y
Silver	NA	0.58	1.0	3.7	1.1	Y
Thallium	2.2	NA	NA	NA	2.36	Y
Vanadium	96.0	NA	NA	NA	48.3	N
Zinc	264	158	150	410	1040	Y

Notes:

NA	Not available	RWQCB	Regional Water Quality Control Board
mg/kg	Milligrams per kilogram	UCL	Upper confidence limit of the mean
ER-L	Effects-range low	ER-M	Effects range median
COPEC	Chemical of potential ecological concern	TBB	Taylor Boulevard Bridge

a See Appendix E

b RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May.

c Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management. Vol. 19. No. 1. Pages 81-97.

d National Oceanic and Atmospheric Administration (NOAA). 1991. "The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program." NOAA, Office of Oceanography and Marine Assessment. Seattle, Washington. Technical Memorandum NOS OMA 52. (Also cited as Long and Morgan 1990.)

e Nondetects were included in the calculation of the 95 percent UCL as one-half of the detection limit.

The aquatic dataset includes samples collected in the aquatic habitat and shoreline area.

f Mercury was not a COPEC based on the ambient and ER-L benchmark screening process, but was reclassified as a COPEC following a review of the metals that dropped out of the screening process.

TABLE 8-12
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
BENCHMARK METRICS FOR BENTHIC INVERTEBRATE COPECS

COPEC	95th % UCL mg/kg	Aquatic Habitat Range[d] mg/kg	Screening Values				Number Locations > Tidal Area Ambient; (Percent)	Number Locations > SF Bay Ambient; (Percent)	Number Locations > ER-L (Percent)	Number Locations > ER-M (Percent)
			Tidal Area Ambient[a] mg/kg	SF Bay Ambient[b] mg/kg	ER-L[c] mg/kg	ER-M[c] mg/kg				
Antimony	5.5	0.50-26.3	2.2	NA	2.0	25.0	11/22 (50)	NA	12/22 (55)	1/22 (5)
Arsenic	29.2	0.50-106	27.0	15.3	8.2	70.0	6/29 (21)	13/29 (45)	22/29 (76)	1/29 (3)
Camium	1.4	0.010-7.8	1.9	0.33	1.2	9.6	4/29 (14)	13/29 (45)	5/29 (17)	0/29 (0)
Chromium	311	0.89-2,990	82.1	112	81.0	370	3/29 (10)	2/29 (7)	2/29 (7)	1/29 (3)
Copper	418	1.1-1,670	81.0	68.1	34.0	270	13/29 (45)	15/29 (45)	25/29 (86)	6/29 (21)
Lead	747	1.7-3,280	95.0	43.2	46.7	218	17/29 (59)	26/29 (90)	25/29 (86)	12/29 (41)
Molybdenum	29.1	0.10-301	6.6	NA	NA	NA	3/29 (10)	NA	NA	NA
Selenium	3.7	0.10-11.5	NA	0.64	0.70	1.4	NA	23/29 (79)	23/29 (79)	18/29 (62)
Silver	1.1	0.045-2.8	NA	0.58	1.0	3.7	NA	10/29 (34)	9/29 (31)	0/29 (0)
Zinc	1040	3.2-4,980	264	158	150	410	14/29 (48)	17/29 (59)	17/29 (59)	12/29 (41)

Notes:
ER-L - Effects range-low (Long and others 1995).
ER-M - Effects range-median (Long and others 1995).
mg/kg - Milligrams per kilogram.
SF- San Francisco.
UCL - Upper conficence limit of the mean

Numbers less than 10 are reported with two significant digits; numbers 10 and greater are reported with three significant digits.

[a] See Appendix E

[b]RWQCB. 1998. "Ambient Concentrations of Toxic chemicals in San Francisco Bay Sediments." Regional Water Quality Control Board. April.

[c]Long, E.R., and others. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." *Environmental Management*. Volume 19, Number 1. Pages 81 through 97.

[d]Concentrations used to compile the range included concentrations of one half the detection limit for those metals that were not detected in the aquatic habitat.

TABLE 8-13
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
HAZARD QUOTIENTS FOR COPECS IN THE AQUATIC HABITAT

Sample Location	Mean ER-M Quotient	Hazard Quotients (Sediment Concentration/ER-M Concentration)									
		Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Selenium	Silver	Zinc
309CSPWSS	**3.4**	0.29	0.81	0.81	0.20	**1.2**	**10.6**	0.55	0.86	0.29	**15.1**
309SB05	0.40	0.049	0.15	0.16	0.088	0.18	0.74	0.11	0.11	0.15	**1.9**
309SB106	0.26	0.016	0.11	0.032	0.079	0.080	**1.2**	0.23	0.071	0.035	0.47
309SSCS	**2.1**	0.13	0.47	0.25	0.14	0.48	**2.5**	0.70	**1.1**	0.11	**13.2**
309SSNS	0.36	0.040	0.20	0.048	0.10	0.18	0.40	0.15	**1.4**	0.070	0.59
309SSSS	0.52	0.043	0.14	0.10	0.095	0.27	0.87	0.12	**1.4**	0.090	**1.5**
SB013	**1.6**	0.11	0.28	0.0037	0.12	**3.8**	**2.7**	0.90	**1.7**	0.68	**6.1**
SB014	**3.5**	0.28	0.88	0.0036	0.21	1.0	**15.0**	0.27	**5.6**	0.70	**11.1**
SB015	**3.3**	**1.1**	0.82	0.0068	**8.1**	**2.7**	**4.7**	0.10	**4.9**	0.76	**10.3**
SB016	0.23	0.063	0.14	0.0208	0.0024	0.0041	0.0078	0.27	**1.4**	0.15	0.021
SB018	**2.7**	0.25	**1.5**	0.0048	0.13	**6.2**	**5.8**	0.30	**5.4**	0.034	**7.5**
SB019	**2.4**	0.17	0.75	0.0034	0.23	**1.6**	**7.5**	0.20	**8.2**	0.024	**4.9**
SB020	**2.8**	0.12	0.33	0.0031	0.20	**7.3**	**5.4**	0.042	**3.0**	0.023	**12.0**
SB100	0.54	0.12	0.089	0.025	0.075	0.20	0.45	0.070	**2.7**	0.46	0.64
SB101	0.26	0.041	0.13	0.0083	0.084	0.14	0.31	0.17	0.89	0.15	0.44
SB102	0.78	0.10	0.083	0.021	0.094	0.19	0.38	0.27	**4.9**	0.39	0.59
SB103	**1.2**	0.13	0.31	0.028	0.091	0.67	**2.3**	0.23	**3.0**	0.50	**3.3**
SB104	0.40	0.083	0.028	0.017	0.062	0.19	0.31	0.18	**1.9**	0.31	0.56
SB105	0.38	0.020	0.0068	0.0041	0.040	0.14	0.11	**2.1**	0.43	0.074	0.50
SB106	0.82	0.070	0.35	0.048	0.40	0.41	**1.2**	0.12	0.68	0.12	**4.0**
SS200	0.67	NA	0.27	0.10	0.14	0.34	0.75	0.077	**1.2**	0.047	**2.4**
SS201	0.44	NA	0.19	0.082	0.090	0.22	0.40	0.035	**1.7**	0.12	0.63
SS202	0.38	NA	0.16	0.069	0.084	0.17	0.33	0.14	**1.2**	0.12	0.71
SS203	0.45	NA	0.17	0.086	0.11	0.20	0.36	0.25	1.0	0.050	**1.4**
SS204	0.99	NA	0.22	0.35	0.10	0.74	0.76	0.37	0.93	0.41	**4.1**
SS205	**3.7**	0.091	0.38	0.25	0.041	0.61	**1.7**	0.0070	0.25	0.17	**33.2**
SS207	0.17	NA	0.046	0.0020	0.035	0.064	0.16	0.30	0.34	0.022	0.39
SS208	0.15	NA	0.056	0.0010	0.034	0.045	0.23	0.31	0.071	0.012	0.41
SS209	0.50	0.061	0.16	0.11	0.056	0.27	0.39	0.41	**1.7**	0.16	**1.2**
Mean Hazard Quotient		0.12	0.32	0.090	0.39	1.0	**2.3**	0.31	**2.0**	0.21	**4.8**

TABLE 8-13
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
HAZARD QUOTIENTS FOR COPECS IN THE AQUATIC HABITAT

Notes:
ER-M - Effects-range median (Long and others 1995).
HQ - Hazard quotient.
NA - Not analyzed.
Bold = HQ > 1
Hazard quotient = Sampling location metal concentration/ER-M metal concentration.
Hazard quotients were calculated for all benthic invertebrate COPECs except molybdenum and thallium. No ER-Ms were available for molybdenum and thallium.
Mean ER-M quotient = Sum of COPEC HQs for one sample location/Number of COPECs present at sample location.
Mean HQ = Sum of HQs for one COPEC/Number of locations
Numbers less than 10 are reported with two significant digits; numbers 10 or greater are reported with three significant digits.

Long, E.R., and others. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." *Environmental Management*. Volume 19, Number 1. Pages 81 through 97.

TABLE 8-14
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD, BIOACCUMULATION FACTORS FOR AMPHIPODS IN THE AQUATIC HABITAT

	309CSIT		309SSCS		309NSIT		309SSNS		309SSIT		309SSSS		
Sample ID	**Tissue (mg/kg wet wt)**	**Tissue (mg/kg dry wt)**	**Sediment (mg/kg dry wt)**	**BAF**	**Tissue (mg/kg wet wt)**	**Tissue (mg/kg dry wt)**	**Sediment (mg/kg dry wt)**	**BAF**	**Tissue (mg/kg wet wt)**	**Tissue (mg/kg dry wt)**	**Sediment (mg/kg dry wt)**	**BAF**	**Max BAF (mg/kg dry wt)**
% Solid	5.1	NA	NA	NA	5.5	NA	NA	NA	5.9	NA	NA	NA	NA
Antimony	0.16	3.1	3.0	1.0	0.24	4.4	0.91	**4.8**	0.46	7.8	0.98	**8.0**	**8.0**
Arsenic	4.5	88.2	32.6	**2.7**	4.9	89.1	14.3	**6.2**	8.3	141	9.8	**14.4**	**14.4**
Cadmium	0.10	2.0	2.4	0.82	0.070	1.3	0.46	**2.8**	0.30	5.1	0.93	**5.5**	**5.5**
Chromium	2.1	41.3	50.8	0.81	1.8	32.8	38.1	0.86	3.7	63.3	35.1	**1.8**	**1.8**
Copper	58.4	1150	130	**8.8**	27.0	491	49.0	**10.0**	42.7	725	72.5	**10.0**	**10.0**
Lead	7.2	141	547	0.26	4.1	74.5	87.2	0.85	22.7	385	189	**2.0**	**2.0**
Mercury	0.12	2.4	0.21	**11.2**	0.11	2.0	0.22	**9.1**	0.080	1.4	0.29	**4.7**	**11.2**
Molybdenum	0.56	11.0	5.2	**2.1**	0.50	9.1	3.1	**2.9**	0.83	14.1	4.2	**3.4**	**3.4**
Selenium	0.98	19.3	1.6	**12.0**	1.2	21.8	2.0	**10.9**	0.50	8.5	2.0	**4.2**	**12.0**
Silver	1.0	19.6	0.42	**46.6**	0.54	9.8	0.26	**37.8**	0.34	5.8	0.33	**17.5**	**46.6**
Thallium	0.0050	0.10	0.14	0.70	0.0050	0.090	0.14	0.65	0.020	0.34	0.13	**2.6**	**2.6**
Zinc	112	2200	1980	**1.1**	157	2860	89.0	**32.1**	89.2	1510	226	**6.7**	**32.1**

Notes:
mg/kg dry wt = milligrams per kilogram in dry weight.
mg/kg wet wt = milligrams per kilogram in wet weight.
BAF- Bioccumulation factor.
COPEC - Chemical of potential ecological concern.
Max - Maximum.
NA - Not applicable.
Bold = BAF > 1
BAF = Tissue concentration (mg/kg dry weight)/Sediment concentration (mg/kg dry weight).
BAFs calculated for chemicals of potential ecological concern.
Chemicals that were not detectied are reported as one half the detection limit.
Tissue (mg/kg dry wt) = Tissue concentration in milligrams per kilogram wet weight/percent solid.

TABLE 8-15
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD, SURVIVAL AND REBUIRIAL OF *EOHAUSTARIUS ESTUARIUS* AMPHIPODS IN BULK SEDIMENT BIOASSAY

Effects of Exposure to TBB Sediments on *Eohaustorius* Survival

Sediment Sample ID	% Survival					
	Rep A	Rep B	Rep C	Rep D	Rep E	Mean[a]
Control	95	100	100	100	95	98
309SSNS	90	75	95	65	60	77
309SSCS	80	90	100	65	95	86
309SSSS	85	90	85	95	85	88

a – Mean is greater than RWQCB 68% reference envelope and 75% lab benchmark

Effects of Exposure to TBB Sediments on *Eohaustorius* Reburial

Sediment Sample ID	% Successful Reburial					
	Rep A	Rep B	Rep C	Rep D	Rep E	Mean
Control	95	95	100	100	95	97
309SSNS	94	100	95	100	83	95
309SSCS	100	100	100	100	100	100
309SSSS	100	100	100	100	100	100

Summary of Overlying Water Quality Conditions

Sediment Sample ID	pH Range	DO Range (mg/L)	Salinity Range (ppt)	Total Ammonia (mg/L - N)		Temperature Range (°C)
				Day 2	Day 8	
Control	7.80-8.06	8.0-8.6	18.0-18.8	0.06	0.05	15.5-17.4
309SSNS	8.02-9.40	8.2-9.5	19.3-20.7	4.14	1.15	15.5-17.5
309SSCS	8.02-9.13	7.8-9.2	19.4-21.0	3.70	1.42	15.5-17.2
309SSSS	8.02-9.29	7.7-9.6	19.9-21.9	2.96	0.16	15.5-17.3

Reference Toxicant Testing: Effects of Cadmium on *Eohaustorius* Survival

Nominal Cadmium Concentration (mg/L)	% Survival		
	Replicate A	Replicate B	Mean
Control	100	100	100
0.75	100	100	100
1.5	90	90	90
3	30	40	35*
6	0	0	0*
9	0	0	0*

*Significantly less than the control at $p < 0.05$.

Notes:

°C – Degrees Celsius
% - percent
DO – Dissolved oxygen
mg/L – Milligrams per liter
ppt – parts per thousand
REP – Replicate
RWQCB – Regional Water Quality Control Board
TBB – Taylor Boulevard Bridge

TABLE 8-16
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
PHYSICAL AND CHEMICAL PARAMETERS AFFECTING BIOAVAILABILITY IN SEDIMENTS

Parameters Affecting Availability of Chemicals in Sediment

Analyte	Unit	Location		
		309SSCS	309SSNS	309SSS
SEM – AVS	NA	-1445	-273	-411
Sediment Fines	%	48.7	64.1	63
pH	pH	7.89	7.56	7.8
Total Organic Carbon	mg/kg	111,000	123,000	104,000

SEM and AVS Data for Composite Sediment Samples from the Aquatic Habitat

Location	SEM – AVS Difference	AVS (μmoles)	Sum Metals (μmoles)	Cadmium (μmoles)	Copper (μmoles)	Lead (μmoles)	Nickel (μmoles)	Zinc (μmoles)
309SSCS	-1445	1483	38.0	0.00067	1.1	4.5	1.0	31.4
309SSNS	-273	276	3.1	0.0088	0.69	0.47	0.42	1.5
309SSSS	-411	423	11.9	0.023	1.1	0.92	6.6	3.3

mg/kg – Milligrams per kilogram
% - percent
μmoles – micro mole
AVS – Acid volatile sulfide
NA – Not applicatble
SEM – Simultaneously extractable metals

TABLE 8-17
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
OVERVIEW OF RISK ASSESSMENT PROCESS FOR BENTHIC INVERTEBRATES

ASSESSMENT ENDPOINT: Protection of populations of benthic invertebrates (sufficient rates of survival and growth to sustain populations of benthic invertebrates)					
SCREENING PROCESS	**COPECS**	**HAZARD AND MEAN QUOTIENTS**	**QUOTIENT RESULTS**	**COPEC LITERATURE REVIEW FOR BENTHIC INVERTEBRATES**	**COECs**
• Calculate 95th percent UCL for each metal at aquatic habitat. • Compare each metal 95th percent UCL to lower of ambient 99th percentile for Concord Tidal Area or ambient 95th percent UCL for San Francisco Bay metal concentrations. • Compare to ER-L benthic invertebrate toxicity benchmark (Long, and others 1995). The metal was a COPEC if it exceeded the lower of the San Francisco Bay *or* Tidal Area ambient concentrations *and* exceeded the ER-L benthic invertebrate toxicity benchmark. Mercury was reclassified as a COPEC after reviewing metals that dropped out of the screening process.	Antimony Arsenic Cadmium Chromium Copper Lead Mercury Molybdenum Selenium Silver Thallium Zinc	• Hazard quotients (sample location metal concentration divided by ER-M benthic invertebrate toxicity benchmark) were calculated for each COPEC except Mo and Tl at each sample location. • Mean ER-M quotients (mean ER-Mq) were calculated across COPECs for each sample location at the habitat. See notes. • Mean hazard quotients were calculated across sample locations for each COPEC at the habitat. See notes. **BIOACCUMULATION** • Used three composite sediment samples. • Calculated bioaccumulation factors (amphipod tissue concentration divided by composite sediment metal concentration). **AMPHIPOD BIOASSAYS** • Used three composite sediment samples in bioassays. • Conducted 10-day, solid-phase sediment toxicity test with amphipod, *Eohaustorius estuarius.* **BIOAVAILABILITY** • Used three composite sediment samples and analyzed for SEM and AVS.	• Using Long and MacDonald (1998) 1.5 benchmark, 7 sample locations and 2 composite samples were potentially at risk. SB013, SB014, SB015, SB018, SB019, SB020, SS205, 309CSPWSS, 309SSCS **BIOACCUMULATION RESULTS** BAFs > 1 (below) suggest uptake. 309SSCS: As, 2.7; Cu, 8.8; Hg, 11.2; Mo, 2.1; Se, 12.0; Ag, 46.6; Zn, 1.1 309SSNS: Sb, 4.8; As, 6.2; Cd, 2.8; Cu, 10.0; Hg, 9.1; Mo, 2.9; Se, 10.7; Ag, 37.6; Zn, 32.1 309SSSS: Sb, 8.0; As, 14.4; Cd, 5.5; Cr, 1.8; Cu, 10.0; Pb, 2.0; Hg, 4.7; Mo, 3.4; Se, 4.2; Ag, 17.3; Zn, 6.7 **AMPHIPOD BIOASSAY RESULTS** • control, 98% mean survival; 309SSNS, 77%; 309SSCS, 86%; 309SSSS, 88%. • control, 98% mean reburial; 309SSNS, 95%; 309SSCS, 100%; 309SSSS, 100%. **BIOAVAILABILITY RESULTS** • SEM-AVS differences were 309SSCS, -1445; 309SSNS, -273; 309SSSS, -411. • Suggests divalent metals not available for uptake.	**Antimony** (Sb). Little literature. Toxicity poorly defined. **Arsenic** (As). Well studied; toxic; can be accumulated. **Cadmium** (Cd). Well studied; toxic; more toxic in freshwater. **Chromium** (Cr). Moderately well studied; toxic; can be accumulated. **Copper** (Cu). Well studied; toxic; generally not accumulated; ultimate sink is bone. **Lead** (Pb). Well studied; toxic; accumulated, but not at high concentrations. **Mercury** (Hg). Well studied; toxic; accumulated and biomagnified in methyl form. **Molybdenum** (Mo). Essential element. Few data for benthic animals; toxicity uncertain. **Selenium** (Se). Well studied; toxic; can be significantly accumulated. **Silver** (Ag). Well studied; very toxic; can be accumulated primarily in seawater. **Thallium** (Tl). Little literature. Toxicity poorly defined. **Zinc** (Zn). Well studied; toxic; generally not accumulated; ultimate sink is bone.	Copper Lead Selenium Zinc See text and Figure 8-8 for explanation of how COECs were chosen.

TABLE 8-17
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
OVERVIEW OF RISK ASSESSMENT PROCESS FOR BENTHIC INVERTEBRATES

<table>
<tr><th colspan="6">ASSESSMENT ENDPOINT: Protection of populations of benthic invertebrates (sufficient rates of survival and growth to sustain populations of benthic invertebrates)</th></tr>
<tr><th>SCREENING PROCESS</th><th>COPECS</th><th>HAZARD AND MEAN QUOTIENTS</th><th>QUOTIENT RESULTS</th><th>COPEC LITERATURE REVIEW FOR BENTHIC INVERTEBRATES</th><th>COECs</th></tr>
<tr>
<td>• Calculate 95th percent UCL for each metal at aquatic habitat.

• Compare each metal 95th percent UCL to lower of ambient 99th percentile for Concord Tidal Area or ambient 95th percent UCL for San Francisco Bay metal concentrations.

• Compare to ER-L benthic invertebrate toxicity benchmark (Long, and others 1995).

The metal was a COPEC if it exceeded the lower of the San Francisco Bay or Tidal Area ambient concentrations and exceeded the ER-L benthic invertebrate toxicity benchmark.

Mercury was reclassified as a COPEC after reviewing metals that dropped out of the screening process.</td>
<td>Antimony
Arsenic
Cadmium
Chromium
Copper
Lead
Mercury
Molybdenum
Selenium
Silver
Thallium
Zinc</td>
<td>• Hazard quotients (sample location metal concentration divided by ER-M benthic invertebrate toxicity benchmark) were calculated for each COPEC except Mo and Tl at each sample location.

• Mean ER-M quotients (mean ER-Mq) were calculated across COPECs for each sample location at the habitat. See notes.

• Mean hazard quotients were calculated across sample locations for each COPEC at the habitat. See notes.

BIOACCUMULATION

• Used three composite sediment samples.

• Calculated bioaccumulation factors (amphipod tissue concentration divided by composite sediment metal concentration).

AMPHIPOD BIOASSAYS

• Used three composite sediment samples in bioassays.

• Conducted 10-day, solid-phase sediment toxicity test with amphipod, Eohaustorius estuarius.

BIOAVAILABILITY

• Used three composite sediment samples and analyzed for SEM and AVS.</td>
<td>• Using Long and MacDonald (1998) 1.5 benchmark, 7 sample locations and 2 composite samples were potentially at risk.
SB013, SB014, SB015, SB018, SB019, SB020, SS205, 309CSPWSS, 309SSCS

BIOACCUMULATION RESULTS
BAFs > 1 (below) suggest uptake.
309SSCS | 309SSNS | 309SSSS
As, 2.7 | Sb, 4.8 | Sb, 8.0
Cu, 8.8 | As, 6.2 | As, 14.4
Hg, 11.2 | Cd, 2.8 | Cd, 5.5
Mo, 2.1 | Cu, 10.0 | Cr, 1.8
Se, 12.0 | Hg, 9.1 | Cu, 10.0
Ag, 46.6 | Mo, 2.9 | Pb, 2.0
Zn, 1.1 | Se, 10.7 | Hg, 4.7
| Ag, 37.6 | Mo, 3.4
| Zn, 32.1 | Se, 4.2
| | Ag, 17.3
| | Zn, 6.7

AMPHIPOD BIOASSAY RESULTS

• control, 98% mean survival; 309SSNS, 77%; 309SSCS, 86%; 309SSSS, 88%.

• control, 98% mean reburial; 309SSNS, 95%; 309SSCS, 100%; 309SSSS, 100%.

BIOAVAILABILITY RESULTS

• SEM-AVS differences were 309SSCS, -1445; 309SSNS, -273; 309SSSS, -411.

• Suggests divalent metals not available for uptake.</td>
<td>Antimony (Sb). Little literature. Toxicity poorly defined.

Arsenic (As). Well studied; toxic; can be accumulated.

Cadmium (Cd). Well studied; toxic; more toxic in freshwater.

Chromium (Cr). Moderately well studied; toxic; can be accumulated.

Copper (Cu). Well studied; toxic; generally not accumulated; ultimate sink is bone.

Lead (Pb). Well studied; toxic; accumulated, but not at high concentrations.

Mercury (Hg). Well studied; toxic; accumulated and biomagnified in methyl form.

Molybdenum (Mo). Essential element. Few data for benthic animals; toxicity uncertain.

Selenium (Se). Well studied; toxic; can be significantly accumulated.

Silver (Ag). Well studied; very toxic; can be accumulated primarily in seawater.

Thallium (Tl). Little literature. Toxicity poorly defined.

Zinc (Zn). Well studied; toxic; generally not accumulated; ultimate sink is bone.</td>
<td>Copper
Lead
Selenium
Zinc

See text and Figure 8-8 for explanation of how COECs were chosen.</td>
</tr>
</table>

TABLE 8-18
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
INORGANIC CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FOR AQUATIC BIRDS

Analyte	Concord Tidal Area Ambient 99th Percentile[a] (mg/kg)	RWQCB San Francisco Bay Sediment Ambient[b] (mg/kg)	TBB Sediment 95% UCL[c] (mg/kg)	Aquatic Birds COPEC
Aluminum	27,300	NA	10590	N
Antimony	2.2	NA	10.1	Y
Arsenic	27.0	15.3	28.7	Y
Barium	530	NA	508	N
Beryllium	0.18	NA	0.24	Y
Cadmium	1.9	0.33	1.7	Y
Chromium	82.1	112	204	Y
Cobalt	36.0	NA	13.5	N
Copper	81.0	68.1	1094	Y
Lead	95.0	43.2	1126	Y
Manganese	1,500	NA	1008	N
Mercury	0.32	0.43	1.7	Y
Molybdenum	6.6	NA	19.4	Y
Nickel	120	112	73.3	N
Selenium	NA	0.64	3.2	Y
Silver	NA	0.58	1.3	Y
Thallium	2.2	NA	1.7	N
Vanadium	96.0	NA	42.0	N
Zinc	264	158	1309	Y

Notes:

mg/kg	milligram per kilogram
COPEC	Chemical of potential ecological concern
TBB	Taylor Boulevard Bridge
UCL	Upper confidence limit of the mean
n = 48	
a	See Appendix E
b	RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May.
c	Nondetects were included in the calculation of the 95 percent UCL as one-half the detection limit.

For locations where surface and subsurface data were available, the maximum concentration was used in the calculation of the 95 percent UCL.

Aquatic bird dataset includes samples collected in the wetland and upland transitional and aquatic habitat.

TABLE 8-19
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE,
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD,
INORGANIC CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN
FOR THE SALT MARSH HARVEST MOUSE

Analyte	Concord Tidal Area Ambient 99th Percentile[a] (mg/kg)	RWQCB San Francisco Bay Sediment Ambient[b] (mg/kg)	TBB Sediment 95% UCL[c] (mg/kg)	SMHM COPEC
Aluminum	27,300	NA	9830	N
Antimony	2.2	NA	14.7	Y
Arsenic	27.0	15.3	37.6	Y
Barium	530	NA	716	Y
Beryllium	0.18	NA	0.30	Y
Cadmium	1.9	0.33	2.1	Y
Chromium	82.1	112	308	Y
Cobalt	36.0	NA	16.6	N
Copper	81.0	68.1	1690	Y
Lead	95.0	43.2	1690	Y
Manganese	1,500	NA	925	N
Mercury	0.32	0.43	2.7	Y
Molybdenum	6.6	NA	28.4	Y
Nickel	120	112	92.2	N
Selenium	NA	0.64	3.8	Y
Silver	NA	0.58	1.6	Y
Thallium	2.2	NA	0.95	N
Vanadium	96.0	NA	36.0	N
Zinc	264	158	1660	Y

Notes:
mg/kg milligram per kilogram
COPEC Chemical of potential ecological concern
TBB Taylor Boulevard Bridge
UCL Upper confidence limit of the mean
n = 30

a See Appendix E

b RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May.

c Nondetects were included in the calculation of the 95 percent UCL as one-half the detection limit.

For locations where surface and subsurface data were available, the maximum concentration was used in the calculation of the 95 percent UCL.

SMHM dataset includes samples collected in the wetland and upland transitional habitat (includes shoreline samples).

TABLE 8-20
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE, NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD, SUMMARY OF HQs FOR THE SALT MARSH HARVEST MOUSE

$HQ_{(low\ dose/high\ TRV)}$	309CSPWSS	309SB05	309SB106	SB01	SB02	SB03	SB04	SB05	SB06	SB07	SB08	SB09	SB10	SB105	SB11	SB12	SB13	SB14	SB15	SB16	SB17	SB18	SB19	SB20	SS206	SS210	SS211	SS212	SS213	SS214	Number of $HQ_{(low\ dose/high\ TRV)}$ greater than 1.0 by chemical
Antimony						5.8	1.3						2.2						1.8												4
Arsenic	1.0		1.1	8.3		20.1	8.7	1.2			1.4	5.4	4.8		2.1		2.8	8.7	8.2	1.3		15.0	7.5	3.2	1.1				1.0	1.1	20
Barium				6.8		1.1	1.4										1.0	1.7	1.0												6
Cadmium				6.8		1.1	1.4										1.0	1.7	1.0												6
Chromium																			6.9												1
Copper						1.8							3.4																		2
Lead																															0
Mercury						11.5						1.0																			2
Molybdenum				7.5		14.0	4.7					1.6	1.9				233.4	3.9	6.0		5.4	5.1	4.7	2.2							12
Selenium							4.4					2.4	2.0				1.2	3.8	3.3	1.0	5.9	3.7	5.6	2.1							11
Zinc				2.0		1.9	1.0					2.6	2.4								1.0										6
Number of $HQ_{(low\ dose/high\ TRV)}$ greater than 1.0 by location	1	0	1	5	0	8	7	1	0	0	1	5	6	0	1	0	5	5	7	2	3	3	3	3	1	0	0	0	1	1	

$HQ_{(high\ dose/high\ TRV)}$	309CSPWSS	309SB05	309SB106	SB01	SB02	SB03	SB04	SB05	SB06	SB07	SB08	SB09	SB10	SB105	SB11	SB12	SB13	SB14	SB15	SB16	SB17	SB18	SB19	SB20	SS206	SS210	SS211	SS212	SS213	SS214	Number of $HQ_{(high\ dose/high\ TRV)}$ greater than 1.0 by chemical
Antimony						13.5	2.9					1.0	5.2					1.0	4.2												6
Arsenic	2.3		2.5	19.1	1.9	46.6	20.1	2.8	2.0	2.0	3.3	12.4	11.1		4.8	2.2	6.5	20.1	18.9	3.1		34.7	17.3	7.5	2.5	1.5	1.0	1.0	2.4	2.7	27
Barium				15.7		2.6	3.1		1.2		1.0	1.3	1.0			1.4	2.3	3.8	2.3					1.1							12
Cadmium						1.3							3.1																		2
Chromium																			15.9												1
Copper						4.2							7.8									1.0		1.2							4
Lead																															0
Mercury						27	2.1					2.2																			3
Molybdenum	1.1			17.4		32.4	10.8				1.5	3.8	4.5				540	9.0	13.8	2.2	12.4	11.8	10.8	5.2	1.2						16
Selenium	1.4						10.2	1.1	1.0	1.1		5.7	4.5		1.1	1.2	2.7	8.8	7.7	2.3	13.6	8.6	13.0	4.8							17
Zinc				4.5		4.4	2.3					6.0	5.5				1.0	1.8	1.7		2.3	1.3		2.0	1.1						12
Number of $HQ_{(high\ dose/high\ TRV)}$ greater than 1.0 by location	3	0	1	4	1	8	7	2	3	2	3	7	8	0	2	3	5	6	7	3	3	5	3	6	3	1	1	1	1	1	

$HQ_{(high\ dose/low\ TRV)}$	309CSPWSS	309SB05	309SB106	SB01	SB02	SB03	SB04	SB05	SB06	SB07	SB08	SB09	SB10	SB105	SB11	SB12	SB13	SB14	SB15	SB16	SB17	SB18	SB19	SB20	SS206	SS210	SS211	SS212	SS213	SS214	Number of $HQ_{(high\ dose/low\ TRV)}$ greater than 1.0 by chemical
Antimony	2.0			9.0	1.3	135	29.0					9.6	51.6			8.0	4.0	10.3	42.2	2.3		9.3	6.1	4.3	1.9			1.0			17
Arsenic	32.2		34.7	263	26.1	640	276	38.8	27.9	27.5	46.0	170	153.2	2.1	66.2	29.7	88.8	277	260	42.8	1.5	478	237	103	34.7	21.2	14.0	14.0	33.3	36.5	29
Barium	3.3	1.2	2.3	60.3	2.9	9.9	12.0	3.2	4.7	2.6	3.9	5.1	3.9	2.7	2.7	5.2	8.8	14.7	8.8	1.6		2.5	2.4	4.3	2.8	1.4	1.6	1.2	1.5	1.1	29
Cadmium	20.6		3.2	2.9		56.6	28.8					34.0	138							2.1					16.5	3.9		3.7	7.1	3.9	13
Chromium				2.9		2.7	2.5						2.1				1.0	1.7	63.8		3.7	1.0	1.8	1.6							11
Copper	7.1	1.9	3.2	88.5	3.7	971	55.0	4.1	2.9	4.4	5.7	47.6	1819	5.4	7.3	10.4	150	39.3	106		74.9	243	62.9	288	82.2	1.9	1.3	2.9	8.3	2.5	29
Lead	12665	1419	1788	24188	328	72564	47525	1899	632	1739	1219	14739	17668	235	3005	7077	5641	30991	9637	16.1	19180	11999	15495	11149	4592	282	420	532	1039	1842	30
Mercury				7.1		448	36					37	11.7				6.6	1.4	2.6	8.4	1.2	1.9	1.4	10.9					4.2		14
Molybdenum	11.1	3.0	5.6	174	1.3	324	107.6	6.5	5.7	6.3	15.1	37.6	44.8	3.6	6.7	6.5	5396.3	89.6	138	21.5	124	118	108	52.0	12.0	1.6	1.6	1.4	1.4	1.8	30
Selenium	32.9		2.4	11.5	8.1	8.2	247	26.0	23.9	26.3	10.6	137	110	16.4	27.4	30.2	65.8	214	186	54.8	329	208	315	115	2.7	5.8	2.5	2.3	2.3	4.7	30
Zinc	20.8	1.8	3.8	218	4.8	211	112	6.7	2.2	6.4	5.3	289	265	4.0	8.2	10.5	48.7	88.6	82.2		110.0	60.3	39.3	96.1	52.5	3.8	2.5	5.6	18.0	4.2	29
Number of $HQ_{(high\ dose/low\ TRV)}$ greater than 1.0 by location	9	5	8	11	8	11	11	7	7	7	7	10	11	7	7	8	10	10	10	8	8	10	10	10	9	8	7	9	9	8	

Note: Blank cells indicate a HQ less than 1.0 HQ = Hazard quotient TRV = Toxicity reference value

APPENDIX A

DATA QUALITY OBJECTIVE STEPS FOR SAMPLING AT THE TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

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APPENDIX A

DATA QUALITY OBJECTIVE STEPS FOR SAMPLING AT THE TAYLOR BOULEVARD BRIDGE DISPOSAL SITE NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
State the Problem	**Identify the Decisions**	**Identify the Inputs to the Decisions**	**Define Study Boundaries**	**Develop Decision Rules**	**Specify Tolerable Limits on Errors**	**Optimize Sampling Design**
*Lead concentrations at some locations are high enough (>250ppm) that remediation is expected. An ERA is required to make decisions about areas outside the 250ppm lead isopleth. *Confirmation of the extent of the glass debris is also necessary.	*Does the nature and extent of chemicals outside the 250 mg/kg isopleth present an unacceptable level of risk to ecological receptors? *Are sediments from the area outside the 250 mg/kg isopleth associated with adverse effects in the bioassays? *Is the ecological risk posed by chemicals in the area outside the 250 mg/kg isopleth sufficient to warrant a risk management decision?	*Validated defensible chemical data for soil, sediment, and prey tissues *inorganic chemicals concentrations in pickleweed tissue, to model the doses to the salt marsh harvest mouse *inorganic chemicals concentrations in benthic invertebrate tissue from the shoreline area to model doses to resident shorebirds *a measure of direct toxicity (toxicity test) to representative benthic invertebrate species, and *A summary of toxicological effects of exposure to representative receptors from the literature.	* For this study the spatial boundary will be limited to the geographical area that has been previously sampled outside the 250 mg/kg lead concentration isopleth from which soil and sediment samples have already been collected.	*If the site chemistry is elevated above screening values and if bioassays show adverse effects, risk will be indicated. *If food-chain modeling shows doses to higher level receptors using invertebrates and pickleweed tissue samples as prey that are above TRVs, then risk to these receptors would be indicated. *If significant risk is indicated at the site, then risk management recommendations will be made.	*The limits on error for the chemical data and tissue analyses are defined in the individual analytical methods. *The limits on error for the bioassay results are defined in the Final Summary Report and Field Work Plan for Supplemental Sampling at TBB (TtEMI 1999). *The limits on error for the weight-of-evidence approach are based on professional judgement.	* The design of the sampling program for this investigation, including the sampling methods, numbers of samples collected, and locations of samples, was based on a review of site-specific historical information, the results of previous investigation activities conducted at the site, and various regulatory guidance documents.

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
State the Problem	**Identify the Decisions**	**Identify the Inputs to the Decisions**	**Define Study Boundaries**	**Develop Decision Rules**	**Specify Tolerable Limits on Errors**	**Optimize Sampling Design**
	*Is there risk to receptors based on food-chain modeling with aquatic invertebrate tissue samples as the prey component?					

Notes:

DQO	Data Quality Objectives
EE/CA	Engineering evaluation and cost analysis
EPA	Environmental Protection Agency
FSP	Field sampling plan
IRP	Installation Restoration Program
MDRD	Minimum detectable relative difference
PRGs	Preliminary Remediation Goals
WP	Work plan

APPENDIX B

DEBRIS TEST HOLE BORE LOGS

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Date: 1/31/2000

LITHOLOGIC BORING LOG

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB001
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1000 FINISH BORING: 1015
TOTAL DEPTH (ft bgs): 2.0	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME: NA	

SYMBOLS:
∇ Static water level
* Staining/ Odor

CONTACTS:
__ Distinct
— Inferred
\ Gradational

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	Description
									ML	SURFACE-DEBRIS (minor) GLASS FRAGMENTS w/ SOME PIECES OF CHARRED WOOD + VEGETATION
										Ø-Ø.5' SANDY SILT (ML), DARK BROWN, MOIST, LOW PLASTICITY, 1Ø-15% VERY FINE GRAINED SAND, SOME ROOT MATERIAL AND GLASS FRAGMENTS
							1		debris	Ø.5-1.5' DEBRIS LAYER OF GLASS FRAGMENTS AND RUSTED METAL
									CL	1.5-2.Ø' SILTY CLAY (CL), OLIVE GRAY, MOIST, MODERATELY PLASTIC
							2			
							3			
							4			
							5			
							6			
							7			
							8			
							9			
							10			

Richard Vernimen

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Date: 1/31/2000	LITHOLOGIC BORING LOG	Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB002
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil and debris
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1020 FINISH BORING: 1040
TOTAL DEPTH (ft bgs): 3.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): 1.0 DATE/TIME: 1/31 1040	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: __ Distinct -- Inferred \ Gradational
									ML w/much glass debris	SURFACE - PICKLEWEED
										SANDY SILT (ML) W/ SOME CLAY AND MOSTLY GLASS FRAGMENT DEBRIS, DARK BROWN, MOIST TO WET W/DEPTH, LOW PLASTICITY, VERY FINE-GRAINED SAND
							1			
										SATURATED, GLASS FRAGMENT/RUST/SOIL MATRIX
							2			
										GLASS FRAGMENT DEBRIS TAPERS OFF FROM 3.0 - 3.5 FT.
							3		ML	
							4			
							5			
							6			
							7			
							8			
							9			
							10			

Richard Vernimen

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Date: 1/31/2000

LITHOLOGIC BORING LOG

Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB003
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1044 FINISH BORING: 1055
TOTAL DEPTH (ft bgs): 3.0	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): 0.5 DATE/TIME: 1/31 1055	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: Distinct — Inferred \ Gradational
									ML	SURFACE: PICKLEWEED AND GLASS DEBRIS
										SANDY SILT (ML), MODERATE DARK BROWN, WET TO
									ML w/ glass debris	SATURATED w/DEPTH, LOW PLASTICITY, 15-20% VERY
							1			FINE GRAINED SAND w/ MANY GLASS FRAGMENTS
										RUSTED METAL AND GLASS DEBRIS
							2		ML w/ glass metal	
							3			SHOVEL REFUSAL AT 3.0 FT. bgs
							4			
							5			
							6			
							7			
							8			
							9			
							10			

Richard Vernimen

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TETRA TECH EM INC.

Date: 1/31/2000

LITHOLOGIC BORING LOG

Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB004
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1100 FINISH BORING: 1115
TOTAL DEPTH (ft bgs): 3.0	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): 0.5 DATE/TIME: 1115	

SYMBOLS: ∇ Static water level; * Staining/Odor

CONTACTS: — Distinct; --- Inferred; \ Gradational

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	Description
									ML w/ glass and rusted metal debris	SURFACE: VEGETATION AND SOME GLASS FRAGMENTS
										0-0.5' SANDY SILT (ML) w/ LITTLE CLAY AND MUCH GLASS AND RUSTED METAL DEBRIS, DARK BROWN, WET TO SATURATED w/ DEPTH, LOW PLASTICITY, 20-30% VERY FINE-GRAINED SAND, SOME ROOT MATERIAL
							1			SATURATED AT 0.5 FT BGS
							2			0.5-3.0' MOSTLY (~85%) GLASS FRAGMENTS AND RUSTY METAL DEBRIS w/ SANDY SILT (ML) AS ABOVE
							3			SHOVEL REFUSAL AT 3.0 FT. BGS + DIFFICULTY REMOVING MATERIAL FROM THE WATER-FILLED HOLE
							4			
							5			
							6			Richard Vernimen
							7			
							8			
							9			
							10			

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Date: 1/31/2000

LITHOLOGIC BORING LOG

Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB005
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1120 FINISH BORING: 1130
TOTAL DEPTH (ft bgs): 2.0	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME:	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: Distinct, Inferred, Gradational
										SURFACE: PICKLEWEED + MINOR GLASS AND WOOD DEBRIS
										0-2.0' SILTY CLAY (CH), OLIVE GRAY, WET, MEDIUM TO HIGH PLASTICITY
							1		CH	
							2			
							3			
							4			
							5			Richard Vernimen
							6			
							7			
							8			
							9			
							10			

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LITHOLOGIC BORING LOG

Date: 1/31/2000

Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB006
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1115 FINISH BORING: 1125
TOTAL DEPTH (ft bgs): 1.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME:	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level; * Staining/Odor. CONTACTS: Distinct; Inferred; Gradational
										SURFACE: PICKLEWEED AND FEW SCATTERED GLASS FRAGMENTS
									ML	0-1.0' SANDY SILT (ML), OLIVE GRAY/BROWN, WET, LOW PLASTICITY, 10-15% VERY FINE-GRAINED SAND. GRADING TO
							1		CH	1.0-1.5' SILTY CLAY (CH), OLIVE GRAY, WET, MEDIUM TO HIGH PLASTICITY
							2			
							3			
							4			
							5			
							6			
							7			
							8			
							9			
							10			

Richard Vernimen

DS.0309.15133

TETRA TECH EM INC.

Date: 1/31/2000

LITHOLOGIC BORING LOG

PROJECT: CTO 309 NWSDB CONCORD CLEAN II

SITE ID: Concord - TBB BORING ID: DB007

PROJECT MANAGER: Cindi Rose

CHARGE NO.: G0069-309B0101

PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings

LOGGED BY: Richard Vernimen

BACKFILL DATE: 1/31/2000 BY: Richard Vernimen

MATERIAL: native soil

WEATHER: partly cloudy, cool, ~60°F

BEGIN BORING: 1130 FINISH BORING: 1140

TOTAL DEPTH (ft bgs): 1.5

LOCATION OF BOREHOLE:

WATER DEPTH (ft bgs): NA DATE/TIME:

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: __ Distinct — Inferred \ Gradational
									ML	SURFACE: VEGETATION, MINOR BRICK FRAGMENTS CLAYEY SILT (ML) w/ TRACE VERY FINE-GRAINED SAND, BROWNISH GRAY, MOIST, LOW PLASTICITY ↓
							1			
							2			
							3			
							4			Richard Vernimen
							5			
							6			
							7			
							8			
							9			
							10			

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Date: 1/31/2000

LITHOLOGIC BORING LOG

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB008
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1120 FINISH BORING: 1130
TOTAL DEPTH (ft bgs): 1.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME:	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: __ Distinct --- Inferred \ Gradational
										SURFACE: GRASS w/ MINOR GLASS FRAGMENT DEBRIS
										0-1.5' SILTY CLAY (CH), GRAYISH BLACK, WET,
									CH	MEDIUM TO HIGH PLASTICITY
							1			↓
							2			
							3			
							4			
							5			
							6			Richard Vernimen
							7			
							8			
							9			
							10			

LITHOLOGIC BORING LOG

Date: 1/31/2000

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB009
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1435 FINISH BORING: 1445
TOTAL DEPTH (ft bgs): 1.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME: —	

SYMBOLS:
▽ Static water level
* Staining/ Odor

CONTACTS:
__ Distinct
— Inferred
\ Gradational

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	Description
										SURFACE: GRASS w/MINOR CONCRETE AND GLASS FRAGMENTS
							1		ML	CLAYEY SILT (ML) w/ TRACE VERY FINE-GRAINED SAND, OLIVE GRAY/BROWN, DAMP, LOW PLASTICITY NO DEBRIS
							2			
							3			
							4			
							5			
							6			
							7			
							8			
							9			
							10			

Richard Vernimen

LITHOLOGIC BORING LOG

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PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DBØ1Ø
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1425 FINISH BORING: 1435
TOTAL DEPTH (ft bgs): 1.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME:	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: Distinct — Inferred ╲ Gradational
										SURFACE: GRASS w/MINOR BRICK AND GLASS FRAGMENTS
							1		ML	CLAYEY SILT (ML) w/ TRACE VERY FINE-GRAINED SAND, OLIVE GRAY/BROWN, DAMP, LOW PLASTICITY NO DEBRIS
							2			
							3			
							4			
							5			Richard Vernimen
							6			
							7			
							8			
							9			
							10			

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LITHOLOGIC BORING LOG

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PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DBØ11
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 113Ø FINISH BORING: 114Ø
TOTAL DEPTH (ft bgs): 2.Ø	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME:	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: __ Distinct --- Inferred \ Gradational
									ML w/ glass debris	SURFACE: GRASS, BRICK & GLASS FRAGMENTS CLAYEY SILT (ML) w/TRACE FINE-GRAINED SAND, OLIVE GRAY/BROWN, DAMP, LOW PLASTICITY, w/ SOME GLASS DEBRIS FROM Ø.5 – 1.Ø BGS
							1			
									ML w/o glass	NO GLASS DEBRIS
							2			
							3			
							4			
							5			
							6			
							7			
							8			
							9			
							10			

Richard Vernimen

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LITHOLOGIC BORING LOG

Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DBΦ12
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 114Φ FINISH BORING: 115Φ
TOTAL DEPTH (ft bgs): 2.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): Φ DATE/TIME:	

SYMBOLS: ∇ Static water level; * Staining/Odor

CONTACTS: __ Distinct; — Inferred; \ Gradational

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	Description
										SURFACE: VEGETATION w/ MUCH GLASS DEBRIS
							1		CL w/glass debris	Φ-1.5' SILTY CLAY (CL) w/ TRACE VERY FINE-GRAINED SAND AND LOTS OF GLASS DEBRIS, OLIVE BROWN/GRAY, WET, LOW PLASTICITY
							2		CH	SILTY CLAY (CH), DARK OLIVE GRAY, WET, MEDIUM TO HIGH PLASTICITY, NO DEBRIS
							3			
							4			
							5			
							6			Richard Vernimen
							7			
							8			
							9			
							10			

Date: 1/31/2000

LITHOLOGIC BORING LOG

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB013
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1145 FINISH BORING: 1155
TOTAL DEPTH (ft bgs): 2.0	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): 0.5 DATE/TIME: 1155	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level; * Staining/ Odor. CONTACTS: __ Distinct; — Inferred; \ Gradational
										SURFACE: PICKLEWEED W/ SOME GLASS FRAGMENTS
									CH w/ glass debris	SILTY CLAY (CH), OLIVE GRAY, WET, MEDIUM TO HIGH PLASTICITY, W/SOME GLASS DEBRIS FROM 0-1.0'
							1			↓ LESS GLASS DEBRIS
									CH	
							2			
							3			
							4			
							5			
							6			
							7			
							8			
							9			
							10			

Richard Vernimen

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LITHOLOGIC BORING LOG

Date: 1/31/2000 | Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB014
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1430 FINISH BORING: 1440
TOTAL DEPTH (ft bgs): 1.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME:	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: __ Distinct --- Inferred \ Gradational
										SURFACE: GRASS (no visible glass debris)
										CLAYEY SILT (ML) w/ TRACE VERY FINE-GRAINED
										SAND, OLIVE GRAY/BROWN, DAMP, LOW PLASTICITY
							1		ML	↓
							2			
							3			
							4			
							5			
							6			
							7			Richard Vernimen
							8			
							9			
							10			

Date: 1/31/2000

LITHOLOGIC BORING LOG

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PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DBØ15
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 143Ø FINISH BORING: 144Ø
TOTAL DEPTH (ft bgs): 1.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME:	

SYMBOLS:
∇ Static water level
* Staining/ Odor

CONTACTS:
__ Distinct
--- Inferred
\ Gradational

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	Description
										SURFACE: GRASS w/ MINOR CONCRETE AND CHARRED WOOD DEBRIS
							1		ML	CLAYEY SILT (ML) w/ TRACE VERY FINE-GRAINED SAND, OLIVE GRAY/BROWN, DAMP, LOW PLASTICITY
							2			
							3			
							4			
							5			Richard Vernimen
							6			
							7			
							8			
							9			
							10			

Date: 1/31/2000

LITHOLOGIC BORING LOG

Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DBØ16
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1155 FINISH BORING: 12Ø5
TOTAL DEPTH (ft bgs): 1.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME:	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level; * Staining/Odor. CONTACTS: __ Distinct; — Inferred; \ Gradational
										SURFACE: PICKLEWEED - no debris
										SILTY CLAY (CL), OLIVE GRAY, MOIST, LOW TO MEDIUM PLASTICITY
							1		CL	NO DEBRIS NOTED TO DEPTH
							2			
							3			
							4			
							5			Richard Vernimen
							6			
							7			
							8			
							9			
							10			

LITHOLOGIC BORING LOG

Date: 1/31/2000		Sheet 1 of 1
PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB	BORING ID: DBØ17
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101	
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen	
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil	
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 12Ø7	FINISH BORING: 121Ø
TOTAL DEPTH (ft bgs): 2.Ø	LOCATION OF BOREHOLE:	
WATER DEPTH (ft bgs): NA DATE/TIME:		

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: _ Distinct — Inferred \ Gradational
										SURFACE: PICKLEWEED (no debris)
									CL	SILTY CLAY (CL), OLIVE GRAY w/ SOME BLACK
										MOTTLING, MOIST, LOW TO MEDIUM PLASTICITY,
							1			
									CL	no debris throughout the interval
							2			
							3			
							4			
							5			
							6			Richard Vernimen
							7			
							8			
							9			
							10			

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Date: 1/31/2000

LITHOLOGIC BORING LOG

Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB018
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1205 FINISH BORING: 1215
TOTAL DEPTH (ft bgs): 2.0	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): NA DATE/TIME:	

SYMBOLS:
∇ Static water level
* Staining/Odor

CONTACTS:
__ Distinct
— Inferred
\ Gradational

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	Description
										SURFACE: VEGETATION (no debris)
										CLAYEY SILT (ML), DARK BROWN, MOIST, LOW TO
									ML	MEDIUM PLASTICITY
							1			
									ML	no debris throughout the interval
							2			
							3			
							4			
							5			
							6			Richard Vernimen
							7			
							8			
							9			
							10			

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Date: 1/31/2000

LITHOLOGIC BORING LOG

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB019
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1440 FINISH BORING: 1500
TOTAL DEPTH (ft bgs): 2.Φ	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): Φ.Φ DATE/TIME: 1/31 1500	

SYMBOLS:
∇ Static water level
* Staining/ Odor

CONTACTS:
__ Distinct
— Inferred
╲ Gradational

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	Description
									mostly debris w/ ML	SURFACE: PICKLEWEED (dead) + GLASS DEBRIS SANDY SILT (ML) w/ TRACE CLAY AND MOSTLY DEBRIS (glass and rusted metal), OLIVE GRAY/BROWN, WET, LOW PLASTICITY
							1			SATURATED, DEBRIS CONTINUES (glass fragments, glass bottles, rust) shovel refusal at 2.Φft. bgs
							2			
							3			
							4			
							5			Richard Vernimen
							6			
							7			
							8			
							9			
							10			

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LITHOLOGIC BORING LOG

Date: 1/31/2000 | Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB020
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1340 FINISH BORING: 1410
TOTAL DEPTH (ft bgs): 3.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): 1.0 DATE/TIME: 1-31/1410	

SYMBOLS:
∇ Static water level
* Staining/ Odor

CONTACTS:
__ Distinct
-- Inferred
\ Gradational

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	Description
									mostly debris w/ ML	SURFACE: PICKLEWEED (dead) + OTHER VEGETATION AND GLASS FRAGMENTS
										SANDY SILT (ML) w/ TRACE CLAY AND MOSTLY DEBRIS (glass and rusted metal), OLIVE GRAY / BROWN, WET, LOW PLASTICITY
							1			
										SATURATED
							2			debris continues, ~~dry~~ GLASS, RUST, BOTTLES
							3			slightly less debris
										shovel refusal at 3.5 ft. bgs
							4			
							5			
							6			Richard Vernimen
							7			
							8			
							9			
							10			

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Date: 1/31/2000

LITHOLOGIC BORING LOG

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB021
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1415 FINISH BORING: 1425
TOTAL DEPTH (ft bgs): 3.0	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): 0.5 DATE/TIME: 1425	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level * Staining/ Odor CONTACTS: __ Distinct -- Inferred \ Gradational
									mostly debris w/ML	SURFACE: PICKLEWEED (dead) + OTHER VEGETATION AND GLASS FRAGMENTS
							1			SANDY SILT (ML) w/ TRACE CLAY AND MOSTLY DEBRIS (glass and rusted metal), OLIVE GRAY/BROWN, WET, LOW PLASTICITY
										SATURATED
							2			DEBRIS CONTINUES (glass w/ rusted metal and ~20% SANDY SILT as above
										somewhat less debris 2.75-3.0 ft. bgs
							3			shovel refusal at 3.0 ft. bgs
							4			
							5			
							6			Richard Vernimen
							7			
							8			
							9			
							10			

Date: 1/31/2000

LITHOLOGIC BORING LOG

Sheet 1 of 1

PROJECT: CTO 309 NWSDB CONCORD CLEAN II	SITE ID: Concord - TBB BORING ID: DB022
PROJECT MANAGER: Cindi Rose	CHARGE NO.: G0069-309B0101
PROJECT TASK: Taylor Blvd. Bridge Site Debris Borings	LOGGED BY: Richard Vernimen
BACKFILL DATE: 1/31/2000 BY: Richard Vernimen	MATERIAL: native soil
WEATHER: partly cloudy, cool, ~60°F	BEGIN BORING: 1410 FINISH BORING: 1420
TOTAL DEPTH (ft bgs): 3.5	LOCATION OF BOREHOLE:
WATER DEPTH (ft bgs): 0.5 DATE/TIME: 1420/1-31	

Sample ID	Sample Time	OVM (ppm)	Drive Interval	Recovered Interval	Lab Sample	Blows per ft	Depth (ft bgs)	Graphic	USCS Soil Type	SYMBOLS: ∇ Static water level; * Staining/Odor. CONTACTS: Distinct; Inferred; Gradational
									Mostly debris w/ML	SURFACE: PICKLEWEED (dead) + OTHER VEGETATION AND GLASS FRAGMENTS
										SANDY SILT (ML) W/ TRACE CLAY AND MOSTLY DEBRIS (glass and rusted metal), OLIVE GRAY/BROWN, WET, LOW PLASTICITY
							1			SATURATED
							2			DEBRIS CONTINUES (glass, rust, some brick fragments)
										SOMEWHAT LESS DEBRIS FROM 2.5 FT. bgs TO DEPTH
							3			shovel refusal at 3.5 ft. bgs
							4			
							5			
							6			
							7			Richard Vernimen
							8			
							9			
							10			

APPENDIX C

TOXICOLOGICAL PROFILES FOR CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN

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C.1 ARSENIC

Arsenic is a naturally occurring element that is widely distributed in the environment and is used in metallurgy to harden copper, lead, and alloys and in the manufacture of certain types of glass. Historically, some forms of arsenic have been used as pesticides.

Arsenic is present in the environment in both inorganic and organic forms. The bioavailability and toxicity of arsenic are dependent upon the chemical and physical forms of arsenic, the exposure route, and the species of concern. Inorganic arsenic is present in the environment in two major forms, arsenate (As5+) and arsenite (As3+). In the environment, arsenate is more abundant and bioaccumulates more rapidly than arsenite; however, arsenite is the more toxic form (Sadiq 1992). Any environmental conditions that promote an increase in arsenite concentrations will increase the toxicity of arsenic in the environment. The oxidation-reduction environment is the most important environmental parameter that affects the bioavailability of arsenic. Reduced conditions in the environment cause the ratio of arsenite to arsenate to increase, thus increasing the toxicity of arsenic in the environment. In addition to oxidation-reduction, the pH of the aquatic environment influences the toxicity of arsenic. As the pH of the water increases, the toxicity of arsenic decreases as more arsenate is produced (Sadiq 1992).

Marine organisms accumulate more arsenic than freshwater organisms. Arsenate is more readily bioaccumulated than arsenite (Sadiq 1992). Bioconcentration factors (BCF) experimentally determined for arsenic appear to be relatively low. The methylated species of arsenic are efficiently transferred in the food chain (Eisler 1988a); however, it does not appear to be biomagnified through the food chain (Eisler, 1988a; Callahan and others 1979; EPA 1982a and 1983e, as cited in ATSDR 1993b).

PLANTS

Terrestrial plants may accumulate arsenic by root uptake from the soil or by absorption of airborne arsenic deposited on the leaves. Certain species of plants may accumulate substantial levels of arsenic (Shaw 1990). Soil concentrations of arsenic have been known to reduce crop plant yields (NRCC 1978, as cited in Eisler 1988a). If the roots of the plant absorb excess arsenic, the plant will stop growing and developing (NRCC 1978, as cited in Eisler 1988a). The chemical form of arsenic absorbed by plants will determine the type of toxic effect plants will have when exposed. Effects can range from inhibition of light activation, wilting, chlorosis, browning, dehydration, and death (National Academy of Science [NAS] 1977, as cited in Eisler 1988a).

Marine phytoplankton have the ability to bioconcentrate inorganic arsenic to high levels, then transform them to methylated arsenic. The methylated species are efficiently transferred in the food chain (Eisler 1988a); however, it does not appear to be biomagnified through the food chain (Eisler 1988a; Callahan and others 1979; EPA 1982a and 1983e, as cited in ATSDR 1993b).

INVERTEBRATES

Arsenic has been used as a pesticide in the past. Arsenic may reduce growth and metabolism of soil microbiota, reduce numbers of bacteria and protozoans, and may adversely affect earthworms to reduce their numbers in the soil (NRCC 1978, as cited in Eisler 1988a).

AMPHIBIANS AND REPTILES

Very little information was available on the effects of arsenic on amphibians and reptiles. One report states, however, that developing toad embryos exposed to arsenic concentrations observed that 50 percent of developing embryos died or were malformed (Eisler 1988a).

FISH AND AQUATIC ORGANISMS

Arsenic can produce both carcinogenic and mutagenic effects in aquatic organisms (Eisler 1988a). Toxic effects of arsenic in fish include impaired behavior, reduced growth, lack of appetite, and failure to metabolize food (Eisler 1988a). The chemical form of arsenic, the type of organism, and the organism's life stage all influence the organism's susceptibility to arsenic compounds. In general, the earlier life stages and smaller organisms are more sensitive to arsenic concentrations (Sadiq 1992).

In addition to the stage of development of an organism, the toxic effect of arsenic is influenced by the type organism. Marine organisms accumulate more arsenic than freshwater organisms. Bioaccumulation of arsenic in marine organisms is influenced by the amount of arsenic in sea water and is further influenced by the marine organism's feeding habits. Bottom feeders appear to be more sensitive to arsenic concentrations than other types of fish (Sadiq 1992). This is because bottom feeders filter the water column and the fine particulate matter in the water for food. Arsenic in the fine particular matter is incidentally ingested during this search for food. As a result, bottom feeders, such as molluscs, accumulate more arsenic in their soft tissue than fish (Sadiq 1992). Fish on the other hand do not have to filter the water column for food, and as a result, the main route of uptake occurs when they filter the water column for oxygen with their gills. This filtering process occurring in the fish gill tissue is the main route of uptake of arsenic for these types of aquatic organisms (Sadiq 1992).

BIRDS

Some species of birds are more sensitive to arsenic exposure, while others appear to be more tolerant of arsenic exposure (Eisler 1988a). The acute oral exposure of inorganic arsenic destroys the blood vessel lining in the gut, which can result in lower blood pressure (Nystrom 1984, as cited in Eisler 1988a). The acute oral exposure of arsenite in birds was observed to cause hepatocyte damage by arsenic inhibition of the sodium pump in cells (Nystrom 1984, as cited in Eisler 1988a). Acute effects of arsenite in birds include, muscular incoordination, debility, slowness, jerkiness, falling, hyperactivity, fluffed feathers, drooped eyelids, huddled position, unkempt appearance, loss of righting reflex, immobility, and seizures (Eisler 1988a). Chronic effects include systemic, growth, behavioral, and reproductive problems (Stanley and others 1994; Whitworth and others 1991; Camardese and others 1990).

MAMMALS

Arsenic is a carcinogen, teratogen, and a possible mutagen. Adverse effects produced by arsenic are highly dose-dependent. At low levels, arsenic may be an essential nutrient and substitute for phosphorous in biochemical reactions (ATSDR 1993b). At high levels, however, arsenic is recognized as an effective poison. Chronic exposure to low levels of arsenic can produce malaise and fatigue, gastrointestinal distress, anemia and basophilic stippling, neuropathy, and skin lesions, which can develop into skin cancer. Water-soluble arsenic is efficiently absorbed from the gastrointestinal tract and circulated throughout the body. Trivalent arsenic is detoxified in the liver by conversion to methylarsenic acid and dimethylarsenic acid, which are the principal forms excreted in the urine. The body burden of arsenic can reach considerable levels because it can be sequestered in nails, hair, bones, teeth, skin, liver, kidneys, and lungs (ATSDR 1993b). In mammalian species, arsenic is a teratogen that can pass the placental barrier and produce fetal death and malformations consisting of exencephaly, eye defects, and renal and gonadal agenesis (Eisler 1988a; ATSDR 1993b; Domingo 1994).

C.2 BARIUM

Barium is an alkaline earth metal that is widely distributed in the environment and is used to produce alloys, paints, soap, paper, rubber, ceramics, and glass. Barium is naturally present in plant and animal tissue and may be an essential element in trace amounts.

The solubility of barium compounds influences the adsorption and toxicity of these compounds. The more soluble barium compounds are more easily adsorbed by organisms and may be accumulated in the skeleton (Amdur and others 1991).

Barium is found mainly in inorganic complexes and is stable in the +2 valence state. Environmental conditions such as pH, Eh, cation exchange capacity, and calcium carbonate levels in soil will affect the movement of barium in the environment (ATSDR 1990a). In an aquatic environment, barium will most likely precipitate out of solution as a $BaSO_4$ or $BaCO_3$ insoluble salt, or the barium ion will absorb to particulate matter (ATSDR 1990a).

Barium can bioaccumulate in terrestrial and aquatic organisms (ATSDR 1990a). Marine plants can bioconcentrate barium by a factor of 1,000 times the concentration found in the water. Marine animals, plankton, and brown algae have reported BCFs of 100, 120, and 260, respectively (Bowen 1966; Schroeder 1970, as cited in ATSDR 1990a). Terrestrial plants bioconcentrate low levels of barium from the soil (Schroeder 1970, as cited in ATSDR 1990a).

PLANTS

Some plants may accumulate barium from soil. Brazil nuts can accumulate high levels of barium (Amdur 1991; ATSDR 1990a).

INVERTEBRATES

No information was available on the effects of barium on invertebrates.

AMPHIBIANS AND REPTILES

No information was available on the effects of barium on amphibians and reptiles.

FISH AND AQUATIC ORGANISMS

In the aquatic environment, the most likely route of particulate metals into fish is through the gill, gut, or skin (Pulsford and others 1992). Very little information was available on the effects of barium on fish and aquatic organisms. In one study, however, barium was observed to inhibit chlorine absorption in the intestine of winter flounder (Charney and Taglietta 1992).

MAMMALS

In addition to skeletal deposition, ingestion of barium salts can result in gastrointestinal distress, muscular paralysis, lowered pulse rate, muscle stimulation, and irregular cardiac contractions (Amdur and others 1991). Rats exposed to barium concentrations in their diet showed toxic responses. In both acute and chronic oral exposure scenarios increased blood pressure was observed in exposed rat populations (ATSDR 1990a). In other acute exposure studies gastrointestinal effects and respiratory weakness were observed in the exposed populations (ATSDR 1990a). Ovary weight and ovary to brain weight ratios both decreased as a result of acute oral exposure to barium in rat populations (Borzelleca and others 1988, as cited in ATSDR 1990a). Published data concerning developmental, reproductive, or carcinogenic effects of barium on mammalian species are very limited (ATSDR 1990a).

C.3 BERYLLIUM

In most types of soil, beryllium is expected to be tightly sorbed onto clay particles (Fishbein 1981, as cited in ATSDR 1993c). Beryllium is expected to have limited mobility in soil, although its mobility may increase as a result of formation of soluble hydroxide complexes in soils of higher pH (Callahan and others 1979, as cited in ATSDR 1993c).

In aquatic environments, most beryllium is usually present sorbed to suspended matter or to sediment, rather than in a dissolved form in the water column. Beryllium may precipitate into sediment as a result of a formation of insoluble complexes and is usually sorbed onto clay particles in sediment. A high percentage of beryllium is expected to be immobile in water as a result of this association with sediment particles, although at a high pH, the formation of water-soluble complexes with hydroxide ions may increase the solubility and mobility of beryllium (Callahan and others 1979, as cited in ATSDR 1993c).

Bioconcentration of beryllium in fish is not likely because of the low absorption of beryllium from the water column by aquatic animals. Significant biomagnification of beryllium within the food chain has not been observed (Fishbein 1981, as cited in ATSDR 1993c).

PLANTS AND INVERTEBRATES

Very little information was available on the effects of beryllium on plants or invertebrates.

AMPHIBIANS AND REPTILES

Very little information was available on the effects of beryllium on amphibians and reptiles. However, in a journal article, Jagoe and others (1993) suggest that the toxic effects of beryllium are similar to those by aluminum. In general, metals induce their toxic effects in the gill surface (skin) of amphibians. Reduced survival of adult populations of frogs and salamanders has been observed when the study organisms were chronically exposed to aluminum in the test water (Horne and Dunson 1995). In addition, aluminum exposure was shown to cause a significant increase in embryonic mortality (Horne and Dunson 1995).

FISH AND AQUATIC ORGANISMS

Very little information was available on the effects of beryllium on fish and aquatic organisms. However, in a journal article, Jagoe and others (1993) suggest that the toxic effects of beryllium are similar to those produced by aluminum. In general, metals induce their toxic effects in the gill surface of aquatic organisms. Like other metals, beryllium affects the physiological processes occurring at the gill surface, including ion regulation and gas exchange (Jagoe and others 1993). At low concentrations, beryllium causes gill damage. At higher concentrations effects include development of chloride cell apical crypts, increased mucus production, microridge loss, epithelial hyperplasia, and fusions of primary lamellae (Jagoe and others 1993). Beryllium water concentrations were found to cause gill abnormalities and damage to the fish species studied (Jagoe and others 1993).

BIRDS

Very little information was available on the effects of beryllium on birds.

MAMMALS

The major toxicological effects of beryllium occur when the compound is inhaled from the air, and beryllium is then deposited in the lungs of mammals. The mammals that were studied include mice, rats, rabbits, and monkeys. The toxicological effects of beryllium in the lung include pneumonitis, hypersensitivity, and chronic granulomatous pulmonary disease (Amdur 1991).

C.4 CADMIUM

Cadmium is a naturally occurring element. It is used in the production of nickel-cadmium batteries, metal plating, pigments, plastics, synthetics, and alloys. Cadmium in soils may leach into water, especially under acidic conditions (Callahan and others 1979; Elinder 1985, as cited in ATSDR 1993d), and cadmium-containing soil particles may be distributed into the air or eroded into water (EPA 1985, as cited in ATSDR 1993d). In the aquatic environment, the bioavailability of cadmium is dependent on such factors as pH, redox potential, water hardness, and the presence of other complexing agents. The most bioavailable form of cadmium is the Cd^{2+} ion. An increase in temperature or salinity will increase the bioavailable form of cadmium and as a result increase the bioaccumulation and toxicity of cadmium to aquatic organisms. A decrease in pH will increase the amount of cadmium ions in water and increase bioaccumulation in aquatic organisms (Sadiq 1992).

Cadmium has no essential biological function and is highly toxic to plants and animals. It is a carcinogen and teratogen, and a suspected mutagen. Cadmium is associated with severe sublethal effects on reproduction at relatively low environmental concentrations (Eisler 1985a). Aquatic and terrestrial organisms at all trophic levels bioconcentrate and bioaccumulate cadmium (Eisler 1985a). Bioconcentration in fish depends on the pH and the organic content of the water (John and others 1987, as cited in ATSDR 1993d). Although some data suggest that lower trophic levels display biomagnification of cadmium, the data available on biomagnification, especially for animals at the top of the food chain, are inconclusive (Beyer 1986; Gochfeld and Burger 1982, as cited in ATSDR 1993d).

PLANTS

Cadmium is known to be toxic to plants at much lower soil concentrations than other heavy metals. Cadmium is more readily taken up by plants than other metals (EPA 1981), and as a result, some plants can accumulate high levels of cadmium in their developing leaflcts (Morishita and Boratynski 1992).

INVERTEBRATES

Some insects can accumulate large quantities of cadmium without observable adverse effects (Jamil and Hussain 1992). Certain insects, such as caddis flies, can accumulate high levels of cadmium in their gill tissue (Sadiq 1992). However, very little information was available concerning the effects of cadmium on invertebrates.

AMPHIBIANS AND REPTILES

Very little information was available concerning the effects of cadmium on amphibians and reptiles.

FISH AND AQUATIC ORGANISMS

Marine organisms appear more resistant to cadmium than freshwater organisms. Cadmium accumulates in the gill tissue of mussels, the digestive glands of scallops, and the liver and kidney of bony fish and sharks (Loring and Prosi 1986; Bryan and Gibbs 1973; Grimanis and others 1978, as cited in Sadiq 1992). In general, however, cadmium accumulates in the liver and kidney of fish (Sindayigaya and others 1994; Sadiq 1992). Cadmium has been shown to be highly toxic in aquatic environments and has been implicated as the cause of deleterious effects on fish and aquatic organisms, including increased mortality, respiratory disruptions, altered enzyme levels, abnormal muscular contractions, reduced growth, and reduced reproduction (Eisler 1985a). Cadmium concentrations in water caused damage to the reproductive organs of fish, a decrease in the survival rate of fish embryos, and a reduction of growth rates of fry (EPA 1976). Crustaceans appear to be more sensitive to cadmium concentrations, as compared to fish and molluscs (Phillips 1980, as cited in Sadiq 1992), and younger stages of aquatic life appear to be more sensitive to cadmium than adults (Sadiq 1992).

BIRDS

Sublethal effects in birds include growth retardation, nephrotoxicity, anemia, damage to the testicles and absorptive epithelium of the duodenum, reduced egg production, and effects on calcium absorption (Scheuhammer 1987).

MAMMALS

In mammalian species, cadmium concentrates in the liver and kidneys and is excreted in the urine at a very slow rate. The acute toxic effects of cadmium given orally produce nausea, vomiting, salivation, diarrhea, and abdominal cramps. Immediate death may be caused by shock and dehydration; renal and cardiopulmonary failure may cause death a week or so after ingestion. Chronic toxicity effects of cadmium given orally to rats are decreased motor skills, peripheral neuropathy, weakness, and muscle atrophy. When inhaled cadmium is a carcinogen that can produce tumors in the lung, trachea, and bronchus.

Cadmium is a known developmental toxin causing teratogenic and mutagenic effects. Parental doses of cadmium have been shown to decrease testosterone and produce adverse effects on the testes and prostate of test animals. Prenatal exposure to cadmium has fetotoxic effects, such as reduced fetal weights (ATSDR 1993d), and can cause adverse effects during the development of the lung, brain, testes, eye, and palate (Domingo 1994). It is believed that small amounts of cadmium could affect embryonic DNA and protein synthesis (Holt and Webb 1987, as cited in Domingo 1994).

C.5 COBALT

Sources of cobalt in the environment are both natural and anthropogenic. Cobalt is naturally present in soil, freshwater, and seawater. Anthropogenic sources of cobalt include fossil fuel burning, vehicular and aircraft exhaust, processing of cobalt-containing alloys and chemicals, sewage sludge, fertilizers derived from phosphate rocks, and copper and nickel smelting and refining (ATSDR 1992a).

Most of the cobalt emitted into the environment settles into the soil or sediment. Cobalt mobility is dependent on the amount of chelating agents in the soil, the pH, and the redox potential of the soil. Lower pH levels increase the mobility of cobalt in the soil. Metal oxides, crystalline minerals, and natural organic matter in the soil decrease the mobility of cobalt. Cobalt is slightly mobilized by normal weathering (pH 5 to 8), moderately mobile in the presence of oxidizing sulfide ore, and immobile in organic-rich environments (Perelman 1967).

In most fresh waters, less than 2 percent of cobalt species are present in the dissolved form in the water column, while the rest is precipitated or adsorbed on suspended solids and sediments. Under acidic conditions and in the presence of excess chloride ions or organic and inorganic chelating agents, some mobilization of cobalt from the sediments may occur (ATSDR 1992a). In these conditions, the formation of cobalt complexes may increase the amount of cobalt in the water column.

Traces of cobalt are accumulated by microorganisms, higher plants, and animals. Although essential, excessive intake results in accumulation and toxicity (Considine 1976). Mollusks, crustaceans, and other bottom feeders have been reported to accumulate large quantities of cobalt (Jenkins 1980). However, a study of organisms in Ottawa River sediments, showed no detectable bioaccumulation of cobalt-60 (Evans and others 1988). Bioaccumulation factors for cobalt on a dry-weight basis were 100 to 4,000 for marine fish and 40 to 1,000 for freshwater fish (Smith and Carson 1981). The concentration of cobalt in normal rat tissues has been shown to range from 0.001 to 0.006 parts per million (ppm) of dry matter (Considine 1976). Cobalt appears not to bioaccumulate significantly in benthic bottom feeders in comparison to its concentration is sediment (ATSDR 1992a).

Plant uptake of cobalt from soil is not appreciable. In highly acidic soils and in some higher plants, however, significant uptake has been observed (ATSDR 1992a). The translocation of cobalt from roots to above-ground parts of plants is not significant in most soils. The soil to plant BCF for cobalt ranges from 0.01 to 0.3 (ATSDR 1992a). Plant uptake of cobalt is enhanced by low soil pH (HSDB 1994) but inhibited by complexes formed by organic complexing agents such as (EDTA) in soil (Killey and others 1984; McLaren and others 1986). There is little biomagnification of cobalt in animals at higher trophic levels (Jenkins 1980).

PLANTS

At elevated levels cobalt is a phytotoxin. However, certain plants are known to develop a mechanism of cobalt tolerance and can grow on serpentinite or ore bodies (Kabata-Pendias and Pendias 1992).

INVERTEBRATES

Very little information was available on the effects of cobalt on invertebrates.

AMPHIBIANS AND REPTILES

Very little information was available on the effects of cobalt on amphibians and reptiles.

FISH AND AQUATIC ORGANISMS

Very little information was available on the effects of cobalt on fish and aquatic organisms. Due to a lack of toxicological data, the EPA has not determined an ambient water quality criterion for cobalt (Diamond and others 1992).

BIRDS

Very little information was available on the effects of cobalt on birds.

MAMMALS

Cardiomyopathy is the primary adverse effect of cobalt in acutely or chronically exposed animals (ATSDR 1992a). Additional studies on animals suggest that exposure to high amounts of cobalt during pregnancy affect fetal health.

Inhalation of cobalt by animals results in respiratory, cardiovascular, hematological, hepatic, renal, ocular, and body weight effects. Short-term exposure of rats to high levels of cobalt in air results in lung damage and death. Short-term exposure of rats, guinea pigs, hamsters, and pigs to lower levels of cobalt in air results in lung damage and increased red blood cells.

Testicular atrophy was reported in rats and mice exposed to cobalt concentrations in air (ATSDR 1992a). Similarly testicular degeneration and atrophy have been reported in rats exposed to cobalt concentrations in water (ATSDR 1992a).

Stunted growth and decreased survival of offspring is noted in study rats exposed to cobalt in their diet from the third trimester of gestation through lactation (Domingo and others 1985). Rodent fetal growth and development, however, were not adversely affected by gestation-only exposure to high cobalt levels (Paternian and others 1988; Seidenberg 1986), so the stunted growth and decreased survival of offspring may be attributable to cobalt transfer through milk.

The rate of absorption of ingested cobalt is variable, depending on such factors as chemical form, nutritional state of body, and preexisting foods in stomach (ATSDR 1992a). Study rats absorbed 30 to 40 percent of the administered dose (Hollins and McCullogh 1971; Taylor 1962).

C.6 COPPER

Copper is a naturally occurring element that is widely distributed in the environment. Copper is the main component of alloys, which include brass, bronze, and gun metal. Copper is an essential trace mineral nutrient and a toxicant (ATSDR 1996).

Copper is very mobile under oxidizing and acidic conditions and immobile in organic-rich and reducing environments. Adsorption increases with pH and with higher organic matter content. In aquatic systems, copper binds primarily to organic matter and forms complexes with both organic and inorganic ligands (mainly with calcium carbonate) that settle out in sediments (Kirk-Othmer 1965). Under normal pH and redox conditions, copper tends to be present in sediments in the form of organic complexes and coprecipitates with iron oxides, manganese oxides, and cupric carbonate complexes.

Copper is an essential nutrient, and under homeostatic control, biomagnification is not a significant fate process for copper. Bioaccumulated copper is stored in the liver, kidney, bone marrow, and hair (Hammond and Beliles 1980, as cited in Talmage and Walton 1991). Fish can bioconcentrate copper with BCFs ranging from the tens to the hundreds. Mollusks have BCFs for copper that range up to 30,000 (Perwack and others 1980; Chapman and others 1968; Raymont 1972).

PLANTS

Based on yield reductions of 14 to 28 percent in agronomic and grassland plants, 100 milligrams per kilogram (mg/kg) of total copper in the soil is considered to be a threshold concentration for toxicity to plants (EPA 1987 and Bengtsson and Tranvik 1989, as cited in International Copper Association [ICA] 1992).

INVERTEBRATES

Based on yield reductions of 14 to 28 percent in agronomic and grassland plants, 100 mg/kg of total copper in the soil is considered to be a threshold concentration for toxicity to soil invertebrates (EPA 1987 and Bengtsson and Tranvik 1989, as cited in ICA 1992). Copper is used as an ingredient in many fungicides and insecticides applied on agricultural crops (Meister 1995).

AMPHIBIANS AND REPTILES

Copper is highly toxic to amphibians. Environmental conditions, including pH and water hardness, and the life stage of the amphibian exposed both affect the organism's sensitivity and adverse response to exposure to metal concentrations in water. Although the information concerning amphibians and metal toxicity is limited, it is believed that the primary mechanism of action of metal-induced toxicity and low pH environments is body loss of sodium across the gill surface (MacDonald and Wood 1993, as cited in Horne and Dunson 1995). Tadpoles were adversely affected when exposed to aqueous copper concentrations (Bayliss 1924, as cited in Owen 1981). Copper is toxic to certain types of frogs and salamanders during both acute and chronic exposure studies, causing embryonic curling, body loss of sodium, and mortality (Horne and Dunson 1995). Copper induced mortality more quickly in high pH and low water hardness environments (Horne and Dunson 1995). The earlier life stages of amphibians appear to be more sensitive to copper toxicity (Horne and Dunson 1995).

No data were found on the effects of copper on reptiles.

FISH AND AQUATIC ORGANISMS

Copper is highly toxic in aquatic environments and is a priority pollutant (EPA 1992). Copper is toxic to many fish and aquatic organisms, including mussels, stripped bass, bluegill, and carp. The gill is the primary organ for concentrating copper in aquatic organisms. Copper is mainly accumulated in the gill, liver, filaments, stomach, and intestine (Harvey 1978, as cited in Owen 1981). Copper concentrations can significantly affect the hatchability of fish eggs and reduce the growth of fry (EPA 1976). The species of the organism and the organism's age influence the toxicity characteristics of copper. In general, younger organisms are affected at lower concentration levels.

BIRDS

Copper can have toxic effects on birds. Diets containing elevated copper levels can slow the growth rate, diminish egg production, and cause developmental abnormalities in different avian species (Owen 1981).

MAMMALS

The toxic effects of copper have been studied on many animals, including cats, dogs, cattle, sheep, rats, mice, horses, guinea pigs, pigs, and monkeys. Different species of animals display varying levels of sensitivity to copper. However, the main organ affected by exposure to copper is the liver where copper primarily accumulates in the subcellular organelles causing liver cirrhosis. In addition to liver cirrhosis, copper exposure can cause necrotic kidney tubules and brain damage (Owen 1981). The acute toxic effects of copper given orally include gastrointestinal irritation, vomiting (including blood), low blood pressure, jaundice due to liver necrosis, and coma. Chronic exposure to copper can cause accumulation of copper in the body leading to lesions in the liver, brain, and eye and hemolytic anemia.

C.7 LEAD

Lead has been characterized as a poison for centuries, and environmental pollution from lead is well documented (Eisler 1988b). Lead has been used in the production of solder, pipes, paint, ceramics, roofing materials, caulking, and ammunition and a gasoline additive. From a geochemical perspective, lead is ubiquitous and occurs in rocks, soils, water, plants, animals, and air. Lead is neither essential nor beneficial to living organisms, and all data show that its metabolic effects are adverse. Lead is a mutagen and a teratogen. When it is absorbed in excessive amounts, lead also is carcinogenic or cocarcinogenic, impairs reproduction, adversely impairs liver and thyroid functions, and interferes with resistance to infectious disease (EPA 1979, as cited in Eisler 1988b). In general, lead is toxic in most of its chemical forms and can be incorporated into the body via inhalation, ingestion, dermal absorption, and placental transfer. Lead is a poison that accumulates in the body, and once the amount in the body reaches a certain level, it starts to affect behavior as well as the hematopoietic, vascular, nervous, renal, and reproductive systems (Eisler 1988b).

The biological availability and fate of lead in soil is affected by such factors as soil pH, organic content, ion-exchange characteristics, and the amount of lead in the soil (NSF 1977, as cited in ATSDR 1993f). Plants and animals may bioconcentrate and bioaccumulate lead; however, biomagnification has not been well documented. Several studies have shown that invertebrates can accumulate lead in their tissues; however, the variability in the extent of lead bioaccumulation suggests much interspecies variation in the mechanisms of lead uptake. Organolead compounds, such as trialkyl and tetraalkyl lead compounds, are more toxic than inorganic forms and have been shown to bioconcentrate in aquatic organisms, as do inorganic lead compounds. High accumulations of lead from ambient sea water by marine plants are well documented. Although lead is bioconcentrated from water, little evidence suggests that it is transferred through the food chain (Wong and others 1978, Branica and Konrad 1980; Settle and Patterson 1980, as cited in Eisler 1988b). Lead concentrations tend to decrease with increasing trophic level in both detrital and grazing food chains in freshwater and marine habitats (Wong and others 1978; Stewart and Schulz-Baldes 1976, as cited in Eisler 1988b).

PLANTS

Lead is not essential for plants, and excessive amounts can cause growth inhibition as well as reduced photosynthesis, mitosis, and water absorption (Demayo and others 1982, as cited in Eisler 1988b).

INVERTEBRATES

A concentration of 12,800 mg/kg of lead in soil is associated with reductions in natural populations of decomposers, such as fungi, earthworms, and arthropods (Beyer and Anderson 1985, as cited in Eisler 1988b).

AMPHIBIANS AND REPTILES

Environmental conditions, including pH and water hardness, and the life stage of the amphibian exposed, affect the organism's sensitivity and adverse response to exposure to metal concentrations in water.

Although the information concerning amphibians and metal toxicity is limited, the primary mechanism of action of metal-induced toxicity and low pH environments is believed to be body loss of sodium across the gill surface (MacDonald and Wood 1993, as cited in Horne and Dunson 1995). Reduced rates of learning acquisition and retention were observed in tadpoles exposed to lead water concentrations (Strickler-Shaw and Taylor 1989, as cited in Freda 1991). Very little evidence has been published on the effects of lead and amphibians; however, lead may be important as a toxicant to developing embryos (Horne and Dunson 1995).

FISH AND AQUATIC ORGANISMS

Lead is toxic to most aquatic organisms; however, the adverse effects are modified by environmental conditions. Fish continuously exposed to toxic concentrations of waterborne lead show various signs of lead poisoning, including spinal curvature, anemia, degeneration of the caudal fin, destruction of spinal neurons, reduced ability to swim against a current, destruction of the respiratory epithelium, muscular atrophy, paralysis, renal pathology, growth inhibition, retardation of sexual maturity, testicular and ovarian histopathology, decreased survival rate of fry, and death (Eisler 1988b; EPA 1976).

BIRDS

Absorbed lead produces a variety of effects in avian species, including damage to the nervous system, muscular paralysis, inhibition of heme synthesis, damage to kidneys, damage to the liver, and death (Mudge 1983, as cited in Eisler 1988b). Sublethal lead exposure may also have adverse effects of reproduction in some avian species by decreasing plasma calcium, inhibition of growth, and reduced hatchability of chicks.

MAMMALS

Lead can have multiple effects in mammalian species. Lead may cause damage to the nervous system, hematological effects, kidney disfunction, sterility, abortion, neonatal mortality, growth retardation, delays in maturation, and reduced body weight (Amdur and others 1991; Eisler 1988b). Younger mammals may have greater sensitivity to lead toxicity due to their developing blood brain barrier. Developing capillaries in the brain allow lead levels in the blood to be transported to newly formed components of the brain (Amdur and others 1991).

C.8 MANGANESE

Manganese is a naturally occurring substance found in many types of soil. Manganese is an essential trace mineral with many oxidation states. Although its primary use is in iron and copper alloys, it is also used in dry cells, matches and pyrotechnics, fossil fuels, and a variety of chemical processes.

Manganese metal has four different oxidation states (2+, 3+, 4+, and 7+). The specific chemical form is determined by environmental factors such as pH, Eh, microbial activity, and available anions (ATSDR 1991). The most common form of manganese is present in the divalent form (Mn^{2+}) (EPA 1984a, as cited in ATSDR 1991). The ability of manganese to adsorb to soil and sediment depends on the organic content present in the soil or sediment and the ion exchange capacity of that medium (Curtin and others 1980, Hemstock and Low 1953, Kabata-Pendias and Pendias 1984, McBride 1979, and Schnitzer 1969, as cited in ATSDR 1991). As a result soil adsorption values range from 0.2 to 10,000 milliliters per gram (mL/g).

Manganese that is present in water may be bioconcentrated by lower trophic levels (ATSDR 1991). Manganese BCFs have been reported as 2,500 to 6,300 for phytoplankton, 300 to 5,500 for marine algae, 800 to 830 for intertidal mussels, and 35 to 930 for coastal fish (Folsom and others 1963, as cited in ATSDR 1991). In another study, BCFs were similarly reported as 10,000 to 20,000 for marine and freshwater plants, 10,000 to 40,000 for invertebrates, and 100 to 600 for fish (Thompson and others 1972, as cited in ATSDR 1991). Although bioconcentration occurs in lower trophic levels, in higher trophic level receptors, homeostasis is reached, and as a result, biomagnification of manganese in the food chain is believed to be insignificant (EPA 1984a, as cited in ATSDR 1991).

PLANTS

Manganese concentrations were found to be higher in the sprout stage than in the adult stage of *Spartina alterniflora* (Williams and Murdoch 1969). However, manganese concentrations increased to the highest levels after death. These concentrations and related concentration factors were similar to those found in terrestrial monocots, marine algae, and submerged grasses (Williams and Murdoch 1969).

INVERTEBRATES

No data were found on the effects of manganese on terrestrial invertebrates.

AMPHIBIANS AND REPTILES

Very little information was available on the effects of manganese on amphibians and reptiles. In one study, however, manganese has been observed to alter membrane sodium permeability in amphibians (Arhem 1980, as cited in Power and others 1989). In adult frogs, the highest concentration of manganese was found to be in the skin (Baudo 1976, as cited in Power and others 1989).

FISH AND AQUATIC ORGANISMS

Reproductive effects, such as a decrease in spermatogenic activity and injury to testis, have been recorded in fish treated with $MnSO_4$ (Srivastava and Agrawal 1983, as cited in Joardan and Sharma 1990).

BIRDS

Manganese levels in birds were higher in bones, livers, and kidneys than in the brain, heart, or muscle (Mahoney 1978). High levels of manganese caused decreased hemoglobin and liver iron levels, mild anemia, and depressed growth in chicks (Southern and Baker 1983). Reproductive effects were minimal in birds fed 90 times the normal dietary level of manganese (Laskey and Edens 1985).

MAMMALS

Symptoms that were observed in rats that ingested elevated levels of manganese included a decrease in weight gain, increase in physical activity, alterations of brain chemicals, slight irritation of the stomach, and delayed testicular development (ATSDR 1991). In addition, pregnant rats that drank water containing levels of manganese were observed to have litters that weighed less than normal (ATSDR 1991). Monkeys that drank water containing elevated levels of manganese became weak, and their muscles became rigid (ATSDR 1991).

Rats and monkeys that inhaled elevated concentrations of manganese dust developed irritation and swelling in the lungs (ATSDR 1991). Monkeys also developed chemical alterations in the brain as a result of manganese inhalation (ATSDR 1991). Mice that were exposed to elevated concentrations of manganese in the air were more likely to catch pneumonia and develop behavioral changes

(ATSDR 1991). The parents who inhaled air concentrations of manganese had increased behavioral malformations and smaller offspring than those of the control group (ATSDR 1991).

C.9 MERCURY

Inorganic and organic forms of mercury are relatively well characterized within an ecotoxicological context. Methyl-mercury and other organomercurical compounds (including ethyl- and phenyl-mercuricals) are among the most toxic organometals in the environment and bioaccumulate through the food chain (Fimreite 1979). The chemical form of mercury influences its distribution in the body, and the comparative toxicity data suggest that the organic species (ethyl- , methyl-, and phenyl-mercury) of the metal are far more toxic than inorganic mercury (Peterle 1991). In general, methyl-mercury as well as its metallic (Hg^0), mercurous (Hg^+), and mercuric (Hg^{++}) form are nonessential and exert their toxicity at the biochemical level as inhibitors of enzyme-catalyzed reactions and protein synthesis.

Mercury is a known mutagen, teratogen, and carcinogen. Its toxicity and environmental effects vary with its form, dose, and route of ingestion and with the species, sex, age, and general condition of the organism (Eisler 1987a, Fimreite 1979). Depending on the pH, salt content, and composition of the soil, mercury usually forms various complexes with chloride and hydroxide ions in the soil (Alloway 1990). Biotransformation is an important fate process in the environmental partitioning of mercury. Under favorable conditions, microorganisms in soil and sediment can convert various forms of mercury to methyl-mercury, which is more available for uptake by various organisms and for transport in the food chain and more mobile than inorganic forms (Peterle 1991).

Mercury has a high potential for bioaccumulation and biomagnification (Eisler 1987a). Methylated mercury is the form most readily bioconcentrated and bioaccumulated (Kramer and Neidhart 1975). Biomagnification of methyl-mercury has been documented for both aquatic and terrestrial food chains (Eisler 1987a). Concentrations of methyl-mercury in higher trophic-level fish have been biomagnified reportedly on the order of 10,000 to 100,000 times those concentrations found in ambient waters (Callahan and others 1979). The accumulation of mercury by aquatic organisms is enhanced at elevated water temperatures, reduced water salinity or hardness, reduced water pH, increased age of the organism, and reduced organic matter in the medium. Mercury transfer and biomagnification through mammalian food chains is well documented.

PLANTS

Plants take up mercury from the soil in relatively insignificant amounts because roots appear to act as a barrier. However, mercury compounds applied to other parts of plants appear to be readily absorbed and translocated (Adriano 1986).

INVERTEBRATES

Some types of invertebrates can accumulate mercury through the food chain with little or no observable effects (Jamil and Hussain 1992). In certain types of flies, however, methyl-mercury can alter chromosomes, causing abnormalities in offspring (NAS 1978 and Khera 1979, as cited in Eisler 1987a). Mercury concentrations in soil have been observed to cause reduced segment regeneration in worms, and at elevated levels, cause mortality (Abbasi and Soni 1983, as cited in Eisler 1987a). For marine invertebrates, mercury was observed to inhibit reproduction (Eisler 1987a).

AMPHIBIANS AND REPTILES

Very little information was available on the effects of mercury on amphibians and reptiles. In one study, however, frogs did not metamorphose when exposed to mercury concentrations (EPA 1980, as cited in Eisler 1987a).

FISH AND AQUATIC ORGANISMS

Methyl-mercury appears to be the most toxic form of mercury (MacDonald 1993). Earlier developmental stages of fish and aquatic organisms are more sensitive to mercury toxicity than the more mature individuals. The effects of chronically exposed fish and aquatic organisms include loss of appetite, brain lesions, cataracts, abnormal motor coordination, and behavioral changes. In addition to the chronic symptoms of mercury toxicity, mercury at comparatively low concentrations adversely affects the reproduction, growth, behavior, metabolism, blood chemistry, osmoregulation, and oxygen exchange of marine and freshwater organisms (Eisler 1987a). Mercury is very toxic to aquatic organisms because of its ability to bind to sulphydryl groups (Sindayigaya 1994). The degree of toxicity is increased in elevated water temperatures and in reduced salinity environments (Eisler 1987a).

BIRDS

Sublethal effects of mercury on birds, administered by a variety of routes, include adverse effects on growth, development, reproduction, blood and tissue chemistry, metabolism, and behavior (Eisler 1987a). Reproductive effects are noted at low doses long before the acute effects are noticeable in the exposed adult populations (Scheuhammer 1987). Significant reproductive effects of chronic dietary inorganic mercury exposure in birds include delayed testicular development, altered mating behavior, reduced fertility, reduced survivability and growth in young, and gonadal atresia. Mercury is also transferred to the egg in avian species, where it has adverse effects on the developing embryo (Peterle 1991).

MAMMALS

Methyl-mercury is the more acutely toxic form of mercury. Mercury can cause adverse neurological, renal, behavioral, and reproductive effects in mammals. Nephrotoxicity is the most common effect mercury has on mammals. Acute toxicity responses to the organic form of the metal include ataxia, aphagia, tremors, and diminished capacities for coordinated movements. In chronic exposures, methyl-mercury intoxication is characterized by central nervous system and peripheral nervous system neuropathies (Lindström and others 1991, as cited in ATSDR 1994b). Methyl-mercury also exhibits reproductive effects in both sexes as well as in the developing embryo and fetus (Cagiano and others 1990). Methyl-mercury can cause other reproductive effects, which include diminished neurological function and behavioral deficits in newborns (Khera and others 1973).

C.10 MOLYBDENUM

Molybdenum is found in all living organisms and is considered to be an essential or beneficial nutrient. This element is primarily used in the production of steel alloys, which are used in building aircraft and weapons. Fossil fuel combustion, smelting, mining, and milling operations have all contributed to molybdenum contamination in the environment. Molybdenum chemistry is complex and not adequately understood. In water at a pH of more than seven, molybdenum exists primarily as the molybdate ion; at a pH of less than seven, various polymeric compounds are formed, including the paramolybdate ion (Busev 1969, as cited in Eisler 1989a). In soils molybdate is sorbed most readily to alkaline, high calcium, and high chloride soils. Retention is lowest in low pH, low sulfate soils (Smith and others 1987, as cited in Eisler 1989a).

Molybdenum interacts toxicologically with other trace elements, especially copper and inorganic sulfates. In mammals, molybdenum can protect against poisoning by copper, mercury, and probably other metals and may have anti-carcinogenic properties. However, ruminants are sensitive to molybdenum poisoning, especially when accompanied by a deficiency in copper or inorganic sulfates (Eisler 1989a).

Very little information on the bioaccumulative potential of molybdenum was found.

PLANTS

Plants readily accumulate molybdate, except in soils with low pH, high sulfate, low phosphate, and high organic matter content (Gupta and Lipsett 1981, as cited in Eisler 1989a). No toxicity of molybdenum to field-grown crops has been observed (Soon and Bates 1985, as cited in Eisler 1989a).

INVERTEBRATES

Molybdenum compounds have been used in baits to control termites. These molybdenum baits were fatal to the termite population; however, the other species of insects including fire ants, beetles, and cockroaches were unaffected by the bait (Brill and others 1987, as cited in Eisler 1989a).

AMPHIBIANS AND REPTILES

Very little information was available on the effects of molybdenum on amphibians and reptiles.

FISH AND AQUATIC ORGANISMS

Freshwater and marine fish appear to be relatively resistant to molybdenum exposure (Eisler 1989a). However, rainbow trout eggs exposure to molybdenum for 28 days through day 4 post-hatch caused mortality at elevated levels. Very little information was available on the effects of molybdenum on aquatic invertebrates and fish.

BIRDS

Data are scarce on the effects of molybdenum on avian wildlife under controlled conditions. All studies on birds have been restricted to domestic poultry, which appear to be relatively resistant to molybdenum exposure. At elevated levels, however, molybdenum has been observed to decrease the growth rate of chicks and turkey poults, reduce egg production, and decrease hatchability (Friberg and others 1975, as cited in Eisler 1989a).

MAMMALS

Molybdenum is essential in mammalian diets, can protect against poisoning by copper or mercury, and may be useful in controlling cancer. Almost all studies conducted to date on the effects of molybdenum under controlled conditions have been on livestock, especially cattle and sheep. Molybdenum poisoning in ruminants has been observed in livestock (Eisler 1989a). In certain areas of England, cattle and sheep that grazed in fields that had high levels of molybdenum and low levels of copper and inorganic sulfate developed molybdenosis (Underwood 1979, as cited in Eisler 1989a). Symptoms of molybdenosis include: weight loss, diarrhea, and death in extreme cases. Data on the effects of molybdenum on mammalian wildlife are scarce. All evidence indicates that other mammals besides cattle and sheep are comparatively tolerant of high dietary intakes of molybdenum (Underwood 1971, Buck 1978, Chappell and others 1979, and Friberg and Lener 1986; as cited in Eisler 1989a).

C.11 NICKEL

Nickel is a naturally occurring metal. Nickel is mined for use in electroplating, iron and steel processing, nickel-cadmium batteries, fuel combustion, and a variety of other applications.

Nickel has many oxidation states: -1, 0, +1, +2, +3, and +4. Ni^{2+}, however, is the most common form present in the environment (Environment Canada 1994a). Nickel is strongly adsorbed by soil, although to a lesser degree than lead, copper, and zinc (Rai and Zachara 1984; Alloway 1990). Many forms of nickel are found in soil, and many factors affect the extent to which these different forms of nickel are adsorbed, making nickel adsorption highly site-specific. Amorphous oxides of iron, manganese, and clay minerals are the most important adsorbents of nickel in soil. In alkaline soils, adsorption may be irreversible, thus limiting nickel's availability and mobility in these soils. Cations, such as calcium and magnesium, reportedly reduce adsorption as a result of competition for binding sites, whereas anions, like sulfate, reduce adsorption because of complexation. Nickel adsorption depends strongly on pH (Rai and Zachara 1984; Alloway 1990). In an aquatic environment, environmental factors, such as pH, redox potential, and organic matter content, can affect the fate, transport, and biological availability of nickel (Environment Canada 1994a).

BCFs for nickel have been reported between 120 and 550 for submerged lichens; 770 and 1,500 for submerged mosses; 2,000 and 4,500 for *Daphnia;* 200 to 1,000 for clams, zooplankton, and benthos; and 230 and 330 for fish (Dietz 1973, Cowgill 1976, Mathis and Cummings 1973, and Hutchinson and others 1976, as cited in Environment Canada 1994a). Recent studies of nickel levels in voles and rabbits living on sludge-amended land did not indicate any accumulation of nickel in these herbivores or in the plants on which they fed (Alberici and others 1989, and Dressler and others 1986, as cited in ATSDR 1993g). Animals appear to be able to regulate the amount of nickel that is accumulated in the body, and as a result, biomagnification in upper trophic levels is believed to be insignificant (Environment Canada 1994a).

PLANTS

Nickel tends to be less available in soils than zinc or cadmium but is generally more available to plants than copper (Alloway 1990). The soil chemistry of nickel is relatively simple and is largely based on its occurrence as the divalent Ni^{2+}. Nickel becomes more soluble with decreasing pH, allowing more nickel to be bioavailable to plants. The clay content and texture of the soil will also influence the bioavailabiltiy of nickel to plants. Depending upon these edaphic factors and on nickel's biological role as a ultra-trace element, nickel is bioconcentrated by plants; the greatest bioconcentration occurs in soils that have naturally high levels of nickel where some plants are classified as "hyperaccumulators" (Alloway 1990). Similar patterns of nickel bioconcentration also occur in highly contaminated soils (for example, near nickel and copper smelters).

The effects of nickel toxicity on plants include reduced growth of roots and shoots, poor branching, deformation of plant parts, decreased dry matter production, leaf spotting, abnormal flower shape, mitotic root tip disturbance, germination inhibition, and chlorosis (Mishra and Kar 1974, Rauser 1978, McIlveen and Negusanti in press, as cited in Environment Canada 1994a).

INVERTEBRATES

Very little information was available on the effects of nickel on invertebrates. However, microorganism growth and survival were reduced as a result of elevated nickel exposure (Babich and Stotzky 1982, as cited in Environment Canada 1994a).

AMPHIBIANS AND REPTILES

Nickel exposure in amphibians has been observed to slow down the response time of the potassium system in myelinated nerve fibers (Arhem 1980, as cited in Power and others 1989). In addition, nickel has also been observed to alter sodium permeability across cell membranes in amphibians (Arhem 1980, as cited in Power and others 1989).

FISH AND AQUATIC ORGANISMS

Nickel is both a carcinogen and a mutagen in the aquatic environment (EPA 1992). The observed effects of nickel exposure in an aquatic environment to fish and invertebrates include tissue damage, genotoxicity, and decreased growth (EIFAC 1984, and IPCS 1991, as cited in Environment Canada 1994a). Molluscs and crustaceans appear to be more sensitive to nickel exposure than other aquatic organisms (Hall 1978, as cited in Environment Canada 1994a).

BIRDS

Elevated dietary concentrations of nickel caused growth inhibition in poultry. The expression of nickel toxicity is influenced by the age, reproductive status, nutritional content of the diet, and exposure duration in test organisms. This information should be considered in the interpretation of the risk posed by nickel to terrestrial wildlife (NAS 1980).

No effects were observed on adult mallards exposed to nickel in their diet. No effects to adult mallards were observed regarding body weight, histological changes in liver and kidneys, tissue damage, blood chemistry, egg-laying ability, hatchability percentages, and hatchling survival to 14 days of age (Eastin and O'Shea 1981, as cited in Environment Canada 1994a). However, mallard ducklings fed diets containing elevated nickel concentrations up to 90 days were observed to develop tremors and ataxia

(Cain and Pafford 1981, as cited in Environment Canada 1994a). Newly hatched chickens were also observed to have slower growth rates as a result of diets containing elevated nickel concentrations (Ling and Leach 1979, as cited in Environment Canada 1994a).

MAMMALS

Growth inhibition was the primary effect to domestic livestock fed elevated levels of nickel in their diet. The expression of nickel toxicity was observed to be influenced by the age, reproductive status, nutritional content of the dict, and exposure duration in test organisms. This information should be considered in the interpretation of the risk posed by nickel to terrestrial wildlife (NAS 1980).

Rats in a subchronic gavage study of nickel chloride in water experienced lethargy, ataxia, irregular breathing, reduced body temperature, and discolored extremities (EPA 1994). Inhalation of nickel subsulfide in rats increased the incidence of lung tumors (ATSDR 1993g). The central nervous system appears to be the target organ for nickel oral toxicity, while the lung is the target organ for inhalation exposure.

C.12 SELENIUM

Selenium is an essential trace element but is harmful at concentrations only slightly higher than the nutritional requirement (Eisler 1985b). Results of laboratory studies and field investigations with fish, mammals, and birds have led to general agreement that elevated concentrations of selenium in diet or water are associated with reproductive abnormalities and growth retardation. Not as extensively documented are reports of selenium-induced chromosomal aberrations, intestinal lesions, shifts in species composition of freshwater algal communities, swimming impairment of protozoans, and behavioral modifications (Eisler 1985b).

In aerobic waters, selenium is present in the selenite (H_2SeO_3, $HSeO_3^{-1}$, SeO_3^{-2}) or selenate (H_2SeO_4, $HSeO_4^-$, SeO_4^{-2}) quadravalent or hexavalent oxidation states. These chemical species are very soluble, and most of the selenium discharged into the aquatic environment is transported in these forms to the ocean. Selenium has a sorptive affinity for hydrous metals oxides, clays, and organic materials. Sorption by sediments or suspended solids can result in enrichment of selenium concentrations in sediment beds. Sorption or precipitation with hydrous iron oxides is probably the major control on mobility of selenium in aerobic waters. Selenium can be methylated by a variety of organisms, including benthic microflora. In a reducing environment, hydrogen selenide may be formed. Both the methylated forms and hydrogen selenide are volatile and may escape to the atmosphere. Formation of volatile selenium compounds in the sediments can remobilize sorbed selenium (Eisler 1985b).

The current understanding of selenium toxicology indicates that ecological effects are primarily caused by selenium in the food chain, rather than selenium dissolved in the water column (Philips 1988, and Luoma and others 1992, as cited in Taylor and others 1992). Once in the water column, selenium enters the food chain through bioconcentration by phytoplankton, which are then consumed in large quantities by crustaceans and bivalves. Crustaceans and bivalves are, in turn, eaten by fish and waterfowl. Bioconcentration, bioaccumulation, and biomagnification of selenium can increase selenium levels more than 1,000 fold from water to fish and animals (Saiki and Lowe 1987, as cited in Taylor and others 1992). The greatest step increase occurs between water and phytoplankton and other aquatic plants; subsequent steps in the food chain typically increase selenium concentrations by a factor of 2 to 6 (Lemly and Smith 1987, as cited in Taylor and other 1992). BCFs for various species of marine algae range from 16,000 to 337,000, depending on the species and the water column levels (Zhang and others 1990, as cited in Taylor 1992).

PLANTS

Selenium has been observed to cause growth retardation in freshwater green algae (Hutchinson and Stokes 1975, Klaverkamp and others 1983, as cited Eisler 1985b).

INVERTEBRATES

Very little information was available on the adverse effects of selenium on invertebrates.

AMPHIBIANS AND REPTILES

Very little information was available on the effects of selenium on amphibians and reptiles. One report, however, states that during frog development, cranial and vertebral deformities and lower survival were documented when exposed to selenium concentrations (Browne and Dumont 1979, as cited in Eisler 1995).

FISH AND AQUATIC ORGANISMS

In general, selenite is more toxic to earlier life stages, and the degree of the effect is increased with increasing temperatures (Klaverkamp and others 1983, as cited in Eisler 1985b). Selenium is teratogenic, and its toxicity depends greatly on its chemical form (Eisler 1985b). It has been suggested that selenite is more toxic than selenate and is preferentially concentrated over selenate by mussels (EPA 1990, as cited in Eisler 1985b). Signs of selenium poisoning include loss of equilibrium, lethargy, loss of coordination, muscle spasms, protruding eyes, swollen abdomen, liver degeneration and swelling, reduced blood hemoglobin levels, increased white blood cell numbers, swollen gill lamella with extensive cellular vacuolization, and necrotic and degenerating ovarian follicles (Ellis and others 1937, Sorensen 1984, as cited in Eisler 1985b). Elevated concentrations of selenium were observed to cause reproductive failure, anemia, reduced hatch, reduced growth, reduced swimming rate, and chromosomal aberrations in aquatic organisms (Hodson and others 1980, Adams 1976, Bovee and O'Brien 1982, Krishnaja and Rege 1982, as cited in Eisler 1985b).

BIRDS

Selenium exposure in the diet or drinking water of avian species is associated with reproductive abnormalities, congenital malformations, selective bioaccumulation, and growth retardation (Eisler 1985b). Selenium has been observed to cause reduced hatching of eggs, decreased egg weight, decreased egg production, anemia, and embryo deformation, including deformed eyes, beaks, wings, and feet (Ort and Latshaw 1978, and Harr 1979, as cited in Eisler 1985b).

MAMMALS

Chronic effects of selenium on mammals include reproductive abnormalities such as congenital malformations; reduced numbers of young in litters; high mortality of young; infertility among surviving young in rats, mice, swine, and cattle; and intestinal lesions (Harr 1978, and NRC 1983, as cited in Eisler 1985b).

Chronic exposure of selenium, known as alkali disease, has been observed in cattle, hogs, and horses that graze on feed containing elevated levels of selenium. Adverse effects include deformed hooves, hair loss, lassitude, articular cartilage erosion, reduced conception, increased reabsorption of fetuses, and heart, kidney, and liver degeneration (Eisler 1985b).

C.13 SILVER

Silver occurs naturally in the environment in the form of silver nitrate, silver chloride, silver sulfide, or silver oxide (USPHS 1990). Some industrial discharges can introduce silver compounds into the environment. It tends to form complexes with inorganic chemicals and humic substances in soils. Consequently, the mobility of silver in soils is affected by drainage and erosion potential, the presence of soil organic matter, oxidation-reduction potential, and pH conditions. Silver tends to be mobile in well-drained soils. Organic matter complexes with silver and causes it to become immobile. Because silver is toxic to soil microorganisms and inhibits bacterial enzymes, biotransformation is not expected to be a significant process (Domsch 1984, as cited in ATSDR 1990c).

The transport and partitioning of silver in surface waters and soils are influenced by the particular form of the compound. The major forms of silver in water include the monovalent ion as sulfate, bicarbonate, or sulfate salts; more complex ions with chlorides and sulfates; and as an integral part of, or adsorbed onto, particulate matter and aquatic biota (Boyle 1968, as cited in ATSDR 1990c). Sorption is the dominant process leading to the partitioning of silver in sediments (Callahan and others 1979, as cited in ATSDR 1990c), and pH and oxidation-reduction conditions affect sorption (Anderson and others 1973, as cited in ATSDR 1990c). When decaying animal and plant material is abundant, silver strongly precipitates as the sulfide form or combines with humic materials (Smith and Carson 1977, as cited in ATSDR 1990c).

Silver is bioaccumulated by marine organisms (Nelson and others 1983). There is no evidence that silver is biomagnified in terrestrial animals, although this may occur in some aquatic invertebrates (Adriano 1986).

PLANTS

Silver is not considered to be highly phytotoxic; even high concentrations in soil appear to have little or no effect on plant growth.

INVERTEBRATES

Very little information was available on the effects of silver on invertebrates.

AMPHIBIANS AND REPTILES

Very little information was available on the effects of silver on amphibians and reptiles.

FISH AND AQUATIC ORGANISMS

Silver is one of the most hazardous trace elements to aquatic species (EPA 1992). The younger life stages of development appear to be the most sensitive to silver concentrations (Klein-MacPhee and others 1984). Silver concentrations have been observed to cause increased larvae mortality, physical abnormalities in developing larvae, reduced hatch, and reduced growth in winter flounder larvae (Klein-MacPhee and others 1984). Juvenile mussels exposed to silver concentrations exhibited growth inhibition (Calabrese and others 1984). Silver also has been observed to effect reproductive behavior and reduce larvae releases from gastropods (Nelson and others 1983).

BIRDS

Very little information was available on the effects of silver on birds.

MAMMALS

Inhalation studies have shown that silver can be absorbed in the lungs, while ingestion studies have shown that silver can be absorbed in the gastrointestinal tract (Amdur and others 1991). Once in the body, silver can accumulate in the liver, while only a small amount is excreted (Amdur and others 1991). A decrease in weight gain was observed in rats exposed to silver in drinking water (Matuk and others 1989, as cited in ATSDR 1990c). Intravenous doses of silver to experimental animals caused pulmonary edema, congestion, and eventual death (Amdur and others 1991).

C.14 THALLIUM

Thallium naturally occurs in the environment. As a trace metal, thallium co-occurs with other metals and coal; its release to the environment is frequently coincidental with industrial activities using these raw materials. Compounds that contain thallium are generally highly soluble in water; hence, thallium may be biologically active in aqueous solution. When in solution, thallium generally occurs as a monovalent cation. In soil and sediments thallium is generally adsorbed to particulates within the physical matrix. The biotic and abiotic processes that influence the cycling of thallium in the environment are poorly understood; however, the biological fate and effects of thallium have been described sufficiently to evaluate its potential risks in aquatic and terrestrial habitats.

Low levels of thallium may be bioconcentrated in an aquatic environment. Experimental thallium BCFs have been determined for aquatic vertebrates and invertebrates, and values range between 10 and 1,500. The majority of these BCFs are reported at less than 100 (Zitko and Carson 1975, Zitko 1975, Barrows and others 1978, as reported in ATSDR 1992c). The relatively large range probably represents species and body size differences in experimental conditions. In terrestrial habitats, plants take up thallium from the rhizosphere; hence, the potential for its entry into terrestrial food chains exists (Ewer 1988, Sharma and others 1986, Cataldo and Wildung 1983, as cited in ATSDR 1992c).

PLANTS

When present in the soil in sufficient quantities, terrestrial vascular plants may bioaccumulate thallium (Ewers 1988; Sharma and Singh 1986). Published information on the effects of thallium on terrestrial microorganisms, plants, and animals is limited (ATSDR 1992c).

INVERTEBRATES

Various forms of thallium have been used as insecticides. Thallium acetate and thallium sulfate were used as ant poisons (Travis 1943).

AMPHIBIANS AND REPTILES

Very little information was available concerning the effects of thallium on amphibians and reptiles; however, in the aquatic environment, study results indicate that thallium is as acutely toxic as copper on a weight basis (Zitko and others 1975).

FISH AND AQUATIC ORGANISMS

Very little information was available concerning the effects of thallium on fish and aquatic organisms; however, in the aquatic environment, study results indicate that thallium is as acutely toxic as copper on a weight basis (Zitko and others 1975). In one study, thallium concentrations reduced the percent embryo hatchability, reduced the growth of fish larvae, and caused mortality in the fish species studied (LeBlanc and Dean 1984).

BIRDS

Very little information was available concerning the effects of thallium on birds. Thallium has been used as a poison to control predators and rodents. Birds, such as eagles, hawks, magpies, and turkey vultures, were accidentally poisoned by these baits (Robinson 1948). In one acute toxicity test, eagles were given a single LD_{50} dose. Effects included loss of muscular coordination, loss of balance, reluctance to move, loss of appetite, belligerence, fear-threat displays, falling, debilitation, loss of righting reflex, distress, breathing complications, and immobility (Bean and Hudson 1976).

MAMMALS

Thallium is very toxic to mammals, and various forms of thallium were once used to control pest populations in the United States. Species that were poisoned by the pesticide include coyotes, dogs, bobcats, rodents, and other animals (Robinson 1948).

In mammals thallium can affect the heart, lung, liver, kidney, nervous system, and reproductive organs (ATSDR 1992c). In rats, exposure to large amounts of thallium for a short period of time can cause heart malfunctions and death. In smaller amounts, rats that drank water containing chronic levels of thallium were observed to have damage to their testes and nervous system (ATSDR 1992c).

C.15 ZINC

Zinc is an essential trace element for all living organisms, and zinc deficiency can be a problem for both plants and animals. Zinc is primarily used as a protective coating for metals and used in the production of alloys such as bronze and brass. The adverse effects of zinc exposure to animals include growth retardation, testicular atrophy, skin changes, and poor appetite (Prasad 1979, as cited in Eisler 1993).

Most of the zinc introduced into aquatic environments is eventually partitioned into sediment. Zinc released from sediment is enhanced under conditions of high dissolved oxygen, low salinity, and low pH. Dissolved zinc usually consists of the hydrated zinc ion and various organic and inorganic complexes. In reducing conditions, organically bound zinc typically forms insoluble sulfides (MacDonald 1993).

BCFs vary widely between and within species of aquatic organisms (Eisler 1993). In marine environments, the most effective zinc accumulators included red and brown algae, ostreid and crassotreid oysters, and scallops. Invertebrates can bioaccumulate large quantities of zinc (Jamil 1992), which could potentially be passed on to higher trophic level consumers. Studies show that bony structures can act as long-term repositories for zinc (Macapinlac and others 1966). Zinc concentrations have been shown to increase with increasing trophic levels from phytoplankton to zooplankton, but not to fish (Balasubramian 1994).

PLANTS

Zinc is an essential nutrient for plant growth in small amounts but is toxic to plants at elevated levels. Zinc can cause significant adverse effects on growth, survival, and reproduction in representative sensitive species of aquatic plants (Eisler 1993). Elevated levels of zinc in soil can cause mortality in some terrestrial plants and inhibit photosynthesis in others (Eisler 1993).

INVERTEBRATES

Certain terrestrial and aquatic invertebrates are sensitive to zinc. Reduced growth, inhibited reproduction, and reduced survival are effects that zinc can have on both terrestrial and aquatic invertebrates (Eisler 1993).

AMPHIBIANS AND REPTILES

Environmental conditions, including pH and water hardness, and the life stage of the amphibian exposed both affect the organism's sensitivity and adverse response to exposure to metal concentrations in water. Although the information concerning amphibians and metal toxicity is limited, the primary mechanism of action of metal induced toxicity and low pH environments is believed to be body loss of sodium across the gill surface (MacDonald and Wood 1993, as cited in Horne and Dunson 1995). In one study there were no significant effects of acute and chronic exposures of frogs and salamanders and their larvae to zinc (Horne and Dunson 1995). In addition, the pH of the aquatic environment had no effect on the toxicity of zinc unlike the other metals that were studied (Horne and Dunson 1995).

However, another study observed that zinc caused significant adverse effects on growth, survival, and reproduction in representative sensitive species of amphibians (Eisler 1993). In this study, zinc was shown to cause teratogenic effects to frog embryos (Eisler 1993).

FISH AND AQUATIC ORGANISMS

The gill epithelium is the primary route of zinc entry into the body of fish (Eisler 1993). Zinc can cause significant adverse effects on growth, survival, and reproduction in representative sensitive species of protozoans, sponges, molluscs, crustaceans, echinoderms, and fish (Eisler 1993). Zinc has been shown to cause teratogenic effects to fish embryos (Eisler 1993).

BIRDS

Different species of birds have varying sensitivities to zinc exposure. Acute effects of zinc in ducks caused mortality and pancreatic degradation (Eisler 1993). Reduced growth and death were observed in poultry chicks fed diets containing elevated zinc levels. Younger stages of life appear to be more sensitive to zinc exposure. The pancreas and bone are primary target organs of zinc in birds (Eisler 1993). Decreased weight gain was observed in Japanese quail, chickens, and turkeys fed diets containing zinc (NAS 1980).

MAMMALS

Zinc is relatively nontoxic in mammals; however, excessive zinc intake adversely affects survival of all tested mammals and produces a wide variety of neurological, hematological, immunological, hepatic, renal, cardiovascular, developmental, and genotoxic effects (PHS 1989, as cited in Eisler 1993). The pancreas and bone are primary target organs of zinc exposure in mammals (Eisler 1993). Toxic effects of zinc can be observed in many domestic animals, including dogs, cats, ferrets, cattle, sheep, and horses, as a result of ingesting zinc-containing objects (Eisler 1993). Zinc concentrations in the diet of pregnant rats and sheep caused increased incidence of hypocuprosis, still births, and fetal resorptions (Ketchenson and others 1969, and Campbell and Mill 1979, as cited in Domingo 1994).

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APPENDIX D

SEDIMENT SAMPLING ANALYTICAL RESULTS

APPENDIX D-1

INORGANIC CHEMICALS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	309SSCS 2/1/2000 0.00 - 0.50[a]			309SSNS 2/1/2000 0.00 - 0.50[a]			309SSSS 2/1/2000 0.00 - 0.50[a]			309SB05 2/2/2000 0.00 - 0.50			309SB106 2/2/2000 0.00 - 0.50			309CSPWSS 2/2/2000 0.00 - 0.50			SB001 2/6/1996 0.00 - 0.50			SB001 2/6/1996 2.00 - 2.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	12900	3.98		14300	3.99		13800	3.79		10500	4.64		12400	3.86		7430	4.19		6970	5		19000	6.6	
ANTIMONY	3.02	0.01	J	0.91	0.01	J	0.98	0.01	J	1.12	0.01	J	0.37	0.01	J	6.72	0.01	J	5.6	0.45	J	0.59	0.59	UJ
ARSENIC	32.6	0.1		14.3	0.1		9.8	0.09		10.4	0.1		7.7	0.1		57	0.1		58.4	0.39		7.6	0.51	
BARIUM	414	0.4		146	0.4		120	0.38		268	0.46		175	0.39		646	0.42		4660	0.08		87.3	0.11	
BERYLLIUM	0.28	0.01		0.32	0.01		0.31	0.01		0.48	0.01		0.4	0.01		0.21	0.01		0.03	0.03	U	0.6	0.04	
CADMIUM	2.38	0.02	J	0.46	0.02	J	0.93	0.02	J	1.55	0.02	J	0.31	0.02	J	7.8	0.02	J	0.56	0.56	U	0.07	0.07	U
CALCIUM	33800	1.99		51300	1.99		31600	1.89		2850	2.32		2780	1.93		10200	2.09		27900	4	J	4000	5.2	J
CHROMIUM	50.8	0.03	J	38.1	0.03	J	35.1	0.03	J	32.5	0.04	J	29.4	0.03	J	73.4	0.04	J	136	0.11		46.3	0.15	
COBALT	11.7	0.004		6.59	0.004		7.35	0.004		14.8	0.005		8.88	0.004		15.8	0.005		23.4	0.11		9.1	0.15	
COPPER	130	0.02	J	49	0.02	J	72.5	0.02	J	49	0.03	J	21.7	0.02	J	311	0.03	J	608	0.14	J	33.6	0.18	J
IRON	94700	1.99		27300	1.99		32900	1.89		20900	2.32		15600	1.93		290000	10.5		328000	31		14800	4	
LEAD	547	7.96		87.2	7.97		189	7.57		162	9.28		268	7.73		2300	41.9		2560	0.22		22.6	0.29	
MAGNESIUM	12500	0.8		15300	0.8		15600	0.76		5970	0.93		5500	0.77		4850	0.84		2490	4.6		8060	6	
MANGANESE	998	0.4		1520	0.4		632	0.38		1940	0.46		422	0.39		1660	2.09		1200	0.03		328	0.04	
MERCURY	0.21	0.01		0.22	0.01		0.29	0.01		0.26	0.01		0.05	0.01	UJ	0.18	0.01		0.42	0.07		0.09	0.09	U
MOLYBDENUM	5.22	0.01	J	3.09	0.01	J	4.15	0.01	J	0.47	0.01	J	0.31	0.01	J	5.13	0.01	J	9.7	0.17		0.24	0.22	U
NICKEL	59.5	0.02	J	40	0.02	J	39	0.02	J	43.2	0.03	J	36.2	0.02	J	59.7	0.03	J	58.6	0.2		41.3	0.26	
POTASSIUM	3960	199		4020	199		4460	189		3830	232		2680	193		1360	209		2600	6.1	J	6480	8	J
SELENIUM	1.6	0.2		2	0.2		2	0.2		0.6	0.3	UJ	0.3	0.2	UJ	1.2	0.3		0.65	0.65	U	0.84	0.84	U
SILVER	0.422	0.01		0.26	0.01		0.333	0.009		0.563	0.01		0.131	0.01		1.08	0.01		5.4	0.14		0.36	0.18	U
SODIUM	46500	11.9		51000	12		63700	11.4		4170	13.9		10500	11.6		2520	12.6		1030	23.6	J	11500	30.8	J
THALLIUM	0.14	0.01	J	0.14	0.01	J	0.13	0.01	J	0.17	0.01	J	0.11	0.01	J	0.14	0.01	J	5.3	5.3	U	0.7	0.7	U
VANADIUM	60.2	0.4		57.4	0.4		55.7	0.38		35.7	0.46		40.1	0.39		40.5	2.09	J	14.2	0.11		49.7	0.15	
ZINC	1980	0.4	J	89	0.4	J	226	0.38	J	284	0.46	J	71.2	0.39	J	2270	2.09	J	4090	2.8		85.3	0.37	

Notes:
U = not detected at detection limit indicated
J = estimated value

INORGANIC CHEMICALS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	309SSCS 2/1/2000 0.00 - 0.50[a]			309SSNS 2/1/2000 0.00 - 0.50[a]			309SSSS 2/1/2000 0.00 - 0.50[a]			309SB05 2/2/2000 0.00 - 0.50			309SB106 2/2/2000 0.00 - 0.50			309CSPWSS 2/2/2000 0.00 - 0.50			SB001 2/6/1996 0.00 - 0.50			SB001 2/6/1996 2.00 - 2.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	12900	3.98		14300	3.99		13800	3.79		10500	4.64		12400	3.86		7430	4.19		6970	5		19000	6.6	
ANTIMONY	3.02	0.01	J	0.91	0.01	J	0.98	0.01	J	1.12	0.01	J	0.37	0.01	J	6.72	0.01	J	5.6	0.45	J	0.59	0.59	UJ
ARSENIC	32.6	0.1		14.3	0.1		9.8	0.09		10.4	0.1		7.7	0.1		57	0.1		58.4	0.39		7.6	0.51	
BARIUM	414	0.4		146	0.4		120	0.38		268	0.46		175	0.39		646	0.42		4660	0.08		87.3	0.11	
BERYLLIUM	0.28	0.01		0.32	0.01		0.31	0.01		0.48	0.01		0.4	0.01		0.21	0.01		0.03	0.03	U	0.6	0.04	
CADMIUM	2.38	0.02	J	0.46	0.02	J	0.93	0.02	J	1.55	0.02	J	0.31	0.02	J	7.8	0.02	J	0.56	0.56	U	0.07	0.07	U
CALCIUM	33800	1.99		51300	1.99		31600	1.89		2850	2.32		2780	1.93		10200	2.09		27900	4	J	4000	5.2	J
CHROMIUM	50.8	0.03	J	38.1	0.03	J	35.1	0.03	J	32.5	0.04	J	29.4	0.03	J	73.4	0.04	J	136	0.11		46.3	0.15	
COBALT	11.7	0.004		6.59	0.004		7.35	0.004		14.8	0.005		8.88	0.004		15.8	0.005		23.4	0.11		9.1	0.15	
COPPER	130	0.02	J	49	0.02	J	72.5	0.02	J	49	0.03	J	21.7	0.02	J	311	0.03	J	608	0.14	J	33.6	0.18	J
IRON	94700	1.99		27300	1.99		32900	1.89		20900	2.32		15600	1.93		290000	10.5		328000	31		14800	4	
LEAD	547	7.96		87.2	7.97		189	7.57		162	9.28		268	7.73		2300	41.9		2560	0.22		22.6	0.29	
MAGNESIUM	12500	0.8		15300	0.8		15600	0.76		5970	0.93		5500	0.77		4850	0.84		2490	4.6		8060	6	
MANGANESE	998	0.4		1520	0.4		632	0.38		1940	0.46		422	0.39		1660	2.09		1200	0.03		328	0.04	
MERCURY	0.21	0.01		0.22	0.01		0.29	0.01		0.26	0.01		0.05	0.01	UJ	0.18	0.01		0.42	0.07		0.09	0.09	U
MOLYBDENUM	5.22	0.01	J	3.09	0.01	J	4.15	0.01	J	0.47	0.01	J	0.31	0.01	J	5.13	0.01	J	9.7	0.17		0.24	0.22	U
NICKEL	59.5	0.02	J	40	0.02	J	39	0.02	J	43.2	0.03	J	36.2	0.02	J	59.7	0.03	J	58.6	0.2		41.3	0.26	
POTASSIUM	3960	199		4020	199		4460	189		3830	232		2680	193		1360	209		2600	6.1	J	6480	8	J
SELENIUM	1.6	0.2		2	0.2		2	0.2		0.6	0.3	UJ	0.3	0.2	UJ	1.2	0.3		0.65	0.65	U	0.84	0.84	U
SILVER	0.422	0.01		0.26	0.01		0.333	0.009		0.563	0.01		0.131	0.01		1.08	0.01		5.4	0.14		0.36	0.18	U
SODIUM	46500	11.9		51000	12		63700	11.4		4170	13.9		10500	11.6		2520	12.6		1030	23.6	J	11500	30.8	J
THALLIUM	0.14	0.01	J	0.14	0.01	J	0.13	0.01	J	0.17	0.01	J	0.11	0.01	J	0.14	0.01	J	5.3	5.3	U	0.7	0.7	U
VANADIUM	60.2	0.4		57.4	0.4		55.7	0.38		35.7	0.46		40.1	0.39		40.5	2.09	J	14.2	0.11		49.7	0.15	
ZINC	1980	0.4	J	89	0.4	J	226	0.38	J	284	0.46	J	71.2	0.39	J	2270	2.09	J	4090	2.8		85.3	0.37	

Notes:

U = not detected at detection limit indicated

J = estimated value

APPENDIX D-1

INORGANIC CHEMICALS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	SB002 2/6/1996 0.00 - 0.50			SB002 2/6/1996 2.00 - 2.50			SB003 2/6/1996 0.00 - 0.50			SB003 2/6/1996 2.00 - 2.50			SB004 3/18/1997 0.00 - 0.50			SB004 3/18/1997 1.00 - 1.50			SB005 3/18/1997 0.00 - 0.50			SB005 3/18/1997 1.00 - 1.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	6300	4.6		9880	4.6		4570	4.7		11600	4.5		4750	4.3		7480	4.1		4200	3.7		7840	4.1	
ANTIMONY	0.8	0.41	J	0.41	0.41	UJ	84.2	0.42	J	0.4	0.4	UJ	18.1	0.4	J	0.37	0.37	UR	0.81	0.34	UJ	0.37	0.37	UR
ARSENIC	5.8	0.36		4.6	0.36		142	0.37		3.1	0.35		61.2	0.5	J	2	0.45	J	8.6	0.41	J	2.9	0.44	J
BARIUM	223	0.08		117	0.08		765	0.08		278	0.07		927	1.96		387	1.9		123	1.7		244	1.9	
BERYLLIUM	0.16	0.03		0.31	0.03		0.03	0.03	UJ	0.33	0.02		0.16	0.16	U	0.55	0.15	J	0.25	0.14	J	0.43	0.15	J
CADMIUM	0.05	0.05	U	0.05	0.05	U	5.5	0.05		0.05	0.05	U	2.8	0.078	J	0.07	0.07	UJ	0.07	0.07	UJ	0.07	0.07	UJ
CALCIUM	2430	3.6	J	977	3.6	J	3160	3.7	J	669	3.5	J	17800	7.15		1090	6.8	J	2530	6.2		1030	6.7	J
CHROMIUM	16.5	0.1		21.2	0.1		125	0.1		23	0.1		119	0.86		17.4	0.82		13.6	0.74		18.3	0.81	
COBALT	12.7	0.1		6.6	0.1		22	0.1		9.5	0.1		37.5	1.9		5.8	1.8	J	9.5	1.7	J	8.5	1.8	J
COPPER	25.7	0.13	J	13.7	0.13	J	6670	0.13	J	12.7	0.12	J	378	0.4	J	12.3	0.38	UJ	28.4	0.34	J	12.1	0.37	UJ
IRON	11700	2.8		12600	2.8		142000	14.4		12500	2.7		272000	237	J	88800	225.4	J	14400	20.3	J	9850	22.2	J
LEAD	34.7	0.21		8	0.2		7680	1.1		6.5	0.2		5030	22.2	J	6.4	0.42	J	201	0.38	J	9.7	0.42	J
MAGNESIUM	3070	4.2		5140	4.1		1680	4.3		5370	4.1		2700	6.1		4020	5.8		1640	5.2		3480	5.8	
MANGANESE	1480	0.03		156	0.03		987	0.03		414	0.02		1420	1.15		312	0.55		428	0.5		368	0.54	
MERCURY	0.06	0.06	U	0.06	0.06	U	26.4	0.7		0.06	0.06	U	2.1	0.065		0.08	0.08	U	0.06	0.05	U	0.07	0.07	U
MOLYBDENUM	0.54	0.15	U	0.15	0.15	U	18.1	0.16	J	0.15	0.15	U	6	0.8		0.74	0.74	U	0.67	0.67	U	0.73	0.73	U
NICKEL	27.8	0.18		24.8	0.18		262	0.18		32.9	0.17		96.3	2.1		27.3	1.9		20.8	1.8		30.2	1.9	
POTASSIUM	3290	5.6	J	3340	5.5	J	1130	5.7	J	3280	5.4	J	869	25.4	J	2950	24.1		1180	21.8		2080	23.8	
SELENIUM	0.59	0.59	U	0.59	0.59	U	0.6	0.6	UJ	0.57	0.57	U	9	0.9	J	0.84	0.84	UJ	0.95	0.76	J	0.83	0.83	UJ
SILVER	0.13	0.13	U	0.13	0.13	U	2.3	0.13		0.12	0.12	U	1.9	1.9	U	1.8	1.8	U	1.6	1.6	U	1.7	1.7	U
SODIUM	2240	21.5	J	5470	21.4	J	630	22	J	7140	20.9	J	1720	6.4		5370	6.1		1660	5.5		5220	6	
THALLIUM	1.4	0.49	U	0.48	0.48	U	2.5	2.5	UJ	0.47	0.47	U	0.32	0.32	U	0.28	0.28	U	0.28	0.28	U	0.28	0.28	U
VANADIUM	26.3	0.1		28.6	0.1		31.3	0.1		30.1	0.1		16.9	0.6		22	0.55		27.3	0.5		30.7	0.54	
ZINC	89.5	0.26		34.3	0.25		3960	1.3		32	0.25		2100	4.4	J	18.8	2.1	J	126	1.9	J	23.5	2.1	J

Notes:
U = not detected at d
J = estimated value

APPENDIX D-1

INORGANIC CHEMICALS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	SB006 3/18/1997 0.00 - 0.50			SB006 3/18/1997 1.00 - 1.50			SB007 3/18/1997 0.00 - 0.50			SB007 3/18/1997 1.00 - 1.50			SB008 3/18/1997 0.00 - 0.50			SB008 3/18/1997 1.00 - 1.50			SB009 3/18/1997 0.00 - 0.50			SB009 3/18/1997 1.00 - 1.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	5400	3.5		12000	3.5		4040	3.5		9350	3.8		7860	3.7		11000	3.7		6360	5.5		6750	3.5	
ANTIMONY	0.71	0.32	UJ	0.35	0.32	UJ	0.95	0.32	UJ	0.39	0.35	UJ	1	0.34	UJ	0.49	0.34	UJ	6	0.5	J	0.32	0.32	UR
ARSENIC	6.2	0.38	J	3.5	0.4	J	6.1	0.4	J	3	0.42	J	10.2	0.4	J	2.6	0.41	J	37.8	0.6	J	4.9	0.38	J
BARIUM	115	1.6		363	1.6		124	1.6		201	1.7		236	1.7		302	1.7		391	2.5		149	1.6	
BERYLLIUM	0.35	0.13	J	0.57	0.13	J	0.3	0.13	J	0.5	0.14	J	0.47	0.13	J	0.58	0.14	J	0.22	0.2	J	0.41	0.13	J
CADMIUM	0.06	0.06	UJ	0.06	0.06	UJ	0.06	0.06	UJ	0.07	0.07	UJ	0.07	0.07	UJ	0.07	0.07	UJ	3.3	0.1	J	0.06	0.06	UJ
CALCIUM	2550	5.8		2200	5.9		2450	5.9		2380	6.4		4710	6.1		1930	6.2		8490	9.2		1540	5.8	
CHROMIUM	15.6	0.7		26.4	0.71		20.5	0.71		21.2	0.77		30.4	0.74		22.8	0.75		43.1	1.1		16.6	0.7	
COBALT	8.3	1.6	J	10.8	1.6		20.5	1.6		10.9	1.7	J	9.8	1.7	J	8.3	1.7	J	19	2.5		10.1	1.6	J
COPPER	20.1	0.32	J	12.9	0.32	UJ	30.5	0.32	J	11.8	0.35	UJ	39.1	0.34	J	14.4	0.34	J	327	0.5	J	13.9	0.32	J
IRON	7870	19.3	J	14000	19.5	J	12800	19.6	J	10600	21.1	J	14700	20.3	J	12100	20.7	J	134000	305	J	10600	19.3	J
LEAD	66.9	0.4	J	8.6	0.36	J	184	0.37	J	7.4	0.4	J	129	0.4	J	8.2	0.4	J	1560	2.9	J	7.8	0.36	J
MAGNESIUM	1840	5		3880	5		1640	5		3620	5.4		4000	5.2		3810	5.3		5030	7.9		2970	5	
MANGANESE	415	0.5		519	0.5		367	0.47		482	0.51		425	0.49		388	0.5		747	0.74		156	0.47	
MERCURY	0.09	0.05	U	0.05	0.05	U	0.19	0.05	U	0.1	0.06	U	0.09	0.05	U	0.07	0.06	U	2.2	0.1		0.08	0.06	U
MOLYBDENUM	0.64	0.64	U	0.64	0.64	U	0.65	0.65	U	0.7	0.7	U	0.84	0.67	J	0.68	0.68	U	2.1	1		0.64	0.64	U
NICKEL	23.2	1.6		47.5	1.7		72.2	1.7		36.6	1.8		49.8	1.7		37.9	1.8		68.6	2.6		24.7	1.6	
POTASSIUM	581	20.7	J	649	20.8	J	605	21	J	510	22.6	J	918	21.7	J	494	22.2	J	1650	33	J	2450	20.6	
SELENIUM	0.74	0.72	J	0.87	0.73	J	0.96	0.73	J	0.79	0.79	UJ	0.76	0.76	UJ	0.77	0.77	UJ	5	1.1	J	0.72	0.72	UJ
SILVER	1.5	1.5	U	1.5	1.5	U	1.5	1.5	U	1.6	1.6	U	1.6	1.6	U	1.6	1.6	U	2.4	2.4	U	1.5	1.5	U
SODIUM	578	5.2	J	3730	5.2		402	5.3	J	3040	5.7		274	5.5	J	2770	5.6		10700	8.2		5730	5.2	
THALLIUM	0.26	0.26	U	0.28	0.28	U	0.24	0.24	U	0.28	0.28	U	0.26	0.26	U	0.28	0.28	U	0.37	0.37	U	0.3	0.3	U
VANADIUM	30.2	0.5		39.8	0.5		27.8	0.47		37.4	0.51		35.2	0.49		30.9	0.5		45.1	0.74		39.6	0.47	
ZINC	42.1	1.8	J	27.6	1.8	J	120	1.8	J	23	2	J	98.9	1.9	J	26	1.9	J	5410	14.1	J	21.5	1.8	J

Notes:
U = not detected at d
J = estimated value

APPENDIX D-1

INORGANIC CHEMICALS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	SB010 3/18/1997 0.00 - 0.50			SB010 3/18/1997 1.00 - 1.50			SB011 3/18/1997 0.00 - 0.50			SB011 3/18/1997 1.00 - 1.50			SB012 3/7/1997 0.00 - 0.50			SB012 3/18/1997 1.00 - 1.50			SB013 10/13/1997 0.00 - 0.50			SB014 10/13/1997 0.00 - 0.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	4920	3.6		8970	4		8090	4.1		9200	3.7		5750	3.2		12900	4		10700	3.9	J	9350	3.9	J
ANTIMONY	32.2	0.33	J	0.47	0.36	UJ	0.66	0.38	UJ	0.34	0.34	UR	5	0.29	J	0.37	0.37	UR	2.5	0.51	J	6.4	0.51	J
ARSENIC	34	0.4	J	2.6	0.43	J	14.7	0.45	J	2.4	0.41	J	6.6	0.35	J	3.4	0.44	J	19.7	0.44		61.4	0.44	
BARIUM	302	1.6		257	1.8		210	1.9		90.2	1.7		127	1.5		404	1.8		680	0.73	J	1140	0.72	J
BERYLLIUM	0.2	0.13	J	0.41	0.15	J	0.33	0.15	J	0.45	0.14	J	0.31	0.12	J	0.52	0.15	J	0.02	0.018	U	0.02	0.018	U
CADMIUM	13.4	0.07	J	0.07	0.07	UJ	0.08	0.08	UJ	0.07	0.07	UJ	0.16	0.06	UJ	0.07	0.07	UJ	0.1	0.071	UJ	0.68	0.07	UJ
CALCIUM	3910	5.9		944	6.6	J	3850	6.9		1690	6.2		1750	5.3		1660	6.7		7370	15.8	J	12500	15.7	J
CHROMIUM	100	0.72		19.9	0.8		29.7	0.83		20.3	0.75		17.7	0.64		27.6	0.8		45.4	0.16	J	78	0.16	J
COBALT	19.1	1.6		10.5	1.8	J	10.2	1.9	J	7.5	1.7	J	13.9	1.4		10.7	1.8	J	11.1	0.23	UJ	21.7	0.23	
COPPER	12500	32.5	J	19	0.36	J	50.2	0.38	J	12.4	0.34	U	71.7	0.29	J	14.3	0.37	J	1030	0.19	J	270	0.19	J
IRON	112000	197	J	10600	21.9	J	13200	22.9	J	10000	20.7	J	8500	17.6	J	14400	22.2	J	62800	11.3	J	234000	112	J
LEAD	1870	3.7	J	7.6	0.41	J	318	0.85	J	6.1	0.4	J	749	1.7	J	9.7	0.41	J	597	0.3	J	3280	0.3	J
MAGNESIUM	1990	5.1		3320	5.6		3730	5.9		3730	5.3		1650	4.5		4300	5.7		8880	15.7		6430	15.6	
MANGANESE	857	0.48		501	0.53		544	0.56		364	0.5		654	0.43		444	0.54		748	0.12	J	1200	1.2	J
MERCURY	0.69	0.06		0.05	0.05	U	0.11	0.06	U	0.08	0.06	U	0.12	0.06	U	0.06	0.06	U	0.39	0.18		0.17	0.16	UJ
MOLYBDENUM	2.5	0.65		0.72	0.72	U	0.75	0.75	U	0.68	0.68	U	0.58	0.58	U	0.73	0.73	U	301	0.21		5	0.21	
NICKEL	73.5	1.7		28.8	1.9		40.3	1.9		28.3	1.8		21.9	1.5		42.6	1.9		48.7	0.16	J	67.2	0.16	J
POTASSIUM	1140	21.1		2100	23.5		1770	24.5		2750	22.1		833	18.8	J	946	23.7	J	3650	34.2		3220	34	
SELENIUM	4	0.74	J	0.82	0.82	UJ	1	0.85	J	0.77	0.77	UJ	1.1	0.66	J	0.98	0.83	J	2.4	0.71		7.8	0.7	
SILVER	1.5	1.5	U	1.7	1.7	U	1.8	1.8	U	1.6	1.6	U	1.4	1.4	U	1.7	1.7	U	2.5	0.19		2.6	0.19	
SODIUM	550	5.3	J	4510	5.9		3490	6.2		6140	5.6		651	4.7	J	5520	6		20600	851		16300	84.5	
THALLIUM	0.27	0.27	U	0.29	0.29	U	0.29	0.29	U	0.29	0.29	U	0.24	0.24	U	0.28	0.28	U	1.1	1.1	U	1.1	1.1	U
VANADIUM	31.2	0.48		35.9	0.53		34.6	0.55		25.4	0.5		31.1	0.43		37	0.54		41.8	0.21		34.8	0.21	
ZINC	4960	36.4	J	24	2.1	J	154	2.1	J	19.5	1.9	J	196	1.6	J	28.1	2.1	J	912	5.7	J	1660	5.6	J

Notes:
U = not detected at d
J = estimated value

APPENDIX D-1

INORGANIC CHEMICALS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	SB015 10/13/1997 0.00 - 0.50			SB016 10/16/1997 0.00 - 0.25			SB017 10/13/1997 0.00 - 0.50			SB018 10/13/1997 0.00 - 0.50			SB019 10/13/1997 0.00 - 0.50			SB020 10/13/1997 0.00 - 0.50			SB100 2/11/1998 0.00 - 0.50			SB101 2/11/1998 0.00 - 0.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	7930	6.9	J	4880	21.7	J	3	3	J	3080	5	J	3430	3.6	J	9650	3.3	J	8450	19.8		12600	6.6	
ANTIMONY	26.3	0.92	J	2.9	2.9	UJ	0.39	0.39	J	5.8	0.67	J	3.8	0.47	J	2.7	0.44	J	5.6	5.6	UJ	1.9	1.9	UJ
ARSENIC	57.7	0.79		9.5	2.5	J	0.34	0.34		106	0.57		52.7	0.41		22.9	0.38		6.2	5.8	J	8.9	1.9	
BARIUM	683	1.3	J	123	4.1	J	5.6	5.6	J	194	0.94	J	184	0.67	J	336	0.62	J	111	6.8	J	56.8	2.2	J
BERYLLIUM	0.03	0.032	U	0.1	0.099	U	0.01	0.014	U	0.02	0.023	U	0.02	0.016	U	0.02	0.015	U	0.16	0.16	U	0.17	0.053	UJ
CADMIUM	0.13	0.13	UJ	0.4	0.4	UJ	0.05	0.054	UJ	0.09	0.092	UJ	0.07	0.065	UJ	0.06	0.06	UJ	0.48	0.48	U	0.16	0.16	U
CALCIUM	16300	28.2	J	67100	88.4	J	10900	12.1	J	7460	20.5	J	3670	14.5	J	4120	13.5	J	40100	170		10800	56.1	
CHROMIUM	2990	0.29	J	0.89	0.89	J	174	0.12	J	47.9	0.21	J	85	0.15	J	74.6	0.14	J	27.6	1.8		30.9	0.59	
COBALT	14.4	0.41	J	1.3	1.3	UJ	36.7	0.18		16.6	0.3		27.8	0.21		12.2	0.2	UJ	7.8	2.7	J	4.8	0.91	J
COPPER	726	0.35	J	1.1	1.1	J	515	0.15	J	1670	0.25	J	432	0.18	J	1980	0.17	J	54.9	3.7		39	1.2	
IRON	126000	20.2	J	63.2	63.2	J	378000	86.7	J	212000	14.6	J	348000	104	J	108000	9.6	J	27700	41.3		17300	13.7	
LEAD	1020	0.54	J	1.7	1.7	J	2030	0.23	J	1270	0.39	J	1640	0.28	J	1180	0.26	J	97.2	2.9	J	67.9	0.96	J
MAGNESIUM	7770	28.2		88.2	88.2		3730	12.1		5980	20.4		5320	14.5		6170	13.4		12500	204		6470	67.6	
MANGANESE	833	0.22	J	0.69	0.69	J	1590	0.95	J	994	0.16	J	1490	1.1	J	591	0.11	J	1360	0.48		330	0.16	
MERCURY	0.16	0.31	U	0.5	0.99	U	0.15	0.14	UJ	0.16	0.22	UJ	0.08	0.17	U	0.64	0.15		0.74	0.37	U	0.28	0.14	U
MOLYBDENUM	7.7	0.38		1.2	1.2	J	6.9	0.16		6.6	0.28		6	0.2		2.9	0.18		8	2.4	J	2.6	0.8	J
NICKEL	79.1	0.29	J	0.89	0.89	J	258	0.12	J	81.5	0.21	J	91.7	0.15	J	126	0.14	J	36.9	3.4	J	35.8	1.1	
POTASSIUM	3410	61.2		192	192		1510	26.3		1710	44.4		1840	31.5		2370	29.2		3570	354	J	3390	117	
SELENIUM	6.8	1.3		4	4	U	12	0.54		7.6	0.92		11.5	0.65		4.2	0.6		7.6	7.6	U	2.5	2.5	U
SILVER	2.8	0.35	J	1.1	1.1	U	11.4	0.15	UJ	1.2	0.25	UJ	0.91	0.18	UJ	0.9	0.17	UJ	3.4	3.4	U	1.1	1.1	U
SODIUM	29500	152		477	477		16600	654		22000	110		20100	784		22000	726		49500	978		14800	323	
THALLIUM	1.9	1.9	U	6	6	U	0.82	0.82	U	1.4	1.4	U	1.7	0.98	UJ	0.91	0.91	U	10.2	10.2	UJ	3.4	3.4	UJ
VANADIUM	39.9	0.38		1.2	1.2	J	28.1	0.16		24.5	0.28		28.1	0.2		39.2	0.18		56.5	2.6	J	43.1	0.85	
ZINC	1540	10.1	J	3.2	3.2	J	2060	4.4	J	1130	7.4	J	737	5.2	J	1800	4.8	J	96	5		65.7	1.7	

Notes:
U = not detected at d
J = estimated value

INORGANIC CHEMICALS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	SB102 2/11/1998 0.00 - 0.50			SB103 2/11/1998 0.00 - 0.50			SB104 2/11/1998 0.00 - 0.50			SB105 2/11/1998 0.00 - 0.50			SB106 2/11/1998 0.00 - 0.50			SS200 6/8/1998 0.00 - 0.50			SS201 6/8/1998 0.00 - 0.50			SS202 6/8/1998 0.00 - 0.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	11200	16.9		8500	21.9		7630	13.5		11900	3.2		17100	5.1		23300	2.2	J	9720	2.8	J	10200	2.7	J
ANTIMONY	4.8	4.8	UJ	6.2	6.2	UJ	3.8	3.8	UJ	0.92	0.92	UJ	1.6	1.4	J	1.4	1.4	R	1.8	1.8	R	1.7	1.7	R
ARSENIC	5.8	5	J	21.8	6.4		3.9	3.9	U	5	0.95	UJ	24.8	1.5		18.8	0.99	J	13.6	1.3	J	11.5	1.2	J
BARIUM	132	5.8	J	198	7.5	J	114	4.6	J	205	1.1		202	1.7		133	0.51	J	120	0.67	J	164	0.62	J
BERYLLIUM	0.14	0.14	U	0.18	0.18	U	0.11	0.11	U	0.026	0.026	U	0.39	0.041	J	0.49	0.027	J	0.04	0.04	J	0.03	0.03	J
CADMIUM	0.41	0.41	U	0.53	0.53	UJ	0.33	0.33	U	0.079	0.079	U	0.46	0.12	J	0.94	0.08	J	0.79	0.11	J	0.66	0.098	J
CALCIUM	53300	145		26800	187		37800	115		8470	27.7		3750	43.5		15300	16.1	J	40500	21.2	J	51600	19.8	J
CHROMIUM	34.9	1.5		33.5	2		23	1.2		14.8	0.29		148	0.46		53.3	0.24	J	33.2	0.32	J	30.9	0.29	J
COBALT	7.7	2.3	J	12.7	3	J	6.5	1.9	J	12.8	0.45	J	7.9	0.7	J	8.7	0.37	J	6.6	0.49	J	5.6	0.46	J
COPPER	52.1	3.2		182	4.1		50.5	2.5		37.1	0.61		111	0.95		91	0.32	J	59.1	0.42	J	47	0.39	J
IRON	30300	35.3		67400	45.6		18500	28.1		23300	6.8		26000	10.6		29500	4.9	J	28800	6.4	J	27200	6	J
LEAD	83.3	2.5	J	506	3.2	J	68.2	2	J	24.9	0.47	J	257	0.75	J	163	0.48	J	87.1	0.63	J	72.2	0.59	J
MAGNESIUM	12800	175		13300	226		9580	139		9980	33.4		7090	52.5		12300	15.5	J	12300	20.4	J	12200	19	J
MANGANESE	1900	0.41		936	0.53		1340	0.33		327	0.079		274	0.12		471	0.053	J	1410	0.07	J	1570	0.066	J
MERCURY	0.75	0.38	U	0.84	0.42	U	0.54	0.27	U	0.12	0.06	U	0.19	0.1	UJ	0.24	0.24	U	0.37	0.37	U	0.31	0.31	U
MOLYBDENUM	3.7	2.1	J	6.2	2.7	J	1.9	1.6	J	0.4	0.4	U	0.8	0.62	J	2.2	0.4	J	4	0.53	J	2.3	0.49	J
NICKEL	37.4	2.9	J	55.8	3.7	J	27.5	2.3	J	23.2	0.55		52.4	0.87		68.8	0.35	J	38.6	0.46	J	33.4	0.43	J
POTASSIUM	3820	302	J	4420	391	J	3230	240	J	5020	57.9		5390	90.9		7080	38.7	J	3750	51	J	3570	47.5	J
SELENIUM	6.9	6.5	J	8.4	8.4	UJ	5.2	5.2	U	1.2	1.2	U	1.9	1.9	U	1.7	1.2		2.4	1.6		1.7	1.5	
SILVER	2.9	2.9	U	3.7	3.7	U	2.3	2.3	U	0.55	0.55	U	1.4	0.87	UJ	0.35	0.35	U	0.46	0.46	J	0.45	0.43	J
SODIUM	34200	835		46600	1080		22400	664		1940	160		7260	251		30900	1390		38000	1830		34900	1710	
THALLIUM	8.7	8.7	UJ	11.2	11.2	UJ	6.9	6.9	UJ	2.1	1.7	J	2.6	2.6	UJ	3.4	1.8	J	3.5	2.4	J	2.6	2.2	J
VANADIUM	53.3	2.2	J	53.1	2.8	J	36.6	1.8	J	62.2	0.42		57.9	0.66		80.5	0.4	J	48.5	0.53	J	46.1	0.49	J
ZINC	87.9	4.3		502	5.5		84.7	3.4		74.3	0.82		596	1.3		358	0.58	J	94	0.82	J	107	0.74	J

Notes:
U = not detected at d
J = estimated value

APPENDIX D-1

INORGANIC CHEMICALS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	SS203 6/8/1998 0.00 - 0.50			SS204 6/8/1998 0.00 - 0.50			SS205 6/8/1998 0.00 - 0.50			SS206 6/8/1998 0.00 - 0.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	12500	2.3	J	13300	2.8	J	1890	1.8	J	5410	0.53	J
ANTIMONY	1.5	1.5	R	1.8	1.8	R	2.1	1.1	J	1.2	0.33	J
ARSENIC	11.9	1.1	J	15.7	1.3	J	26.8	0.82	J	7.7	0.24	J
BARIUM	120	0.54	J	131	0.67	J	67.4	0.42	J	215	0.12	J
BERYLLIUM	0.03	0.03	J	0.04	0.04	J	0.02	0.02	J	0.02	0.0066	UJ
CADMIUM	0.83	0.086	J	3.4	0.11	J	2.4	0.067	J	1.6	0.02	J
CALCIUM	44500	17.3	J	21900	21.2	J	10800	13.4	J	4270	4	J
CHROMIUM	39.7	0.26	J	38.2	0.32	J	15.2	0.2	J	28.9	0.059	J
COBALT	6.9	0.4	J	10.9	0.49	J	5.6	0.31	J	9.6	0.092	J
COPPER	54.1	0.34	J	199	0.42	J	166	0.27	J	565	0.079	J
IRON	27900	5.2	J	41200	6.4	J	63200	4.1	J	48600	1.2	J
LEAD	78.8	0.51	J	165	0.63	J	378	0.4	J	486	0.12	J
MAGNESIUM	10500	16.6	J	13000	20.3	J	3810	12.9	J	2360	3.8	J
MANGANESE	1060	0.057	J	830	0.07	J	311	0.044	J	321	0.013	J
MERCURY	0.26	0.26	U	1.5	0.32		0.17	0.17	U	0.05	0.05	U
MOLYBDENUM	4.1	0.43	J	4.1	0.53	J	3	0.33	J	0.67	0.098	J
NICKEL	41.4	0.37	J	49.5	0.46	J	25.9	0.29	J	229	0.085	J
POTASSIUM	3590	41.5	J	4990	50.9	J	997	32.3	J	1190	9.5	J
SELENIUM	1.4	1.3	J	1.3	1.6	J	0.69	0.69	UJ	0.2	0.2	U
SILVER	0.37	0.37	U	1.5	0.46	J	0.62	0.29	J	6.7	0.085	
SODIUM	18400	149		52800	1830		11400	116		1640	34.1	
THALLIUM	1.9	1.9	J	2.4	2.4	J	2.5	1.5	J	1.6	0.44	J
VANADIUM	62.9	0.43	J	53.4	0.53	J	20.3	0.33	J	16.8	0.098	J
ZINC	205	0.66	J	609	0.79	J	4980	5.3	J	983	1.5	J

Sample Location Sample Date Sample Depth (ft.)	SS207 6/8/1998 0.00 - 0.50			SS208 6/8/1998 0.00 - 0.50			SS209 6/8/1998 0.00 - 0.50			SS210 6/8/1998 0.00 - 0.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	5200	1	J	6440	0.53	J	6870	2	J	8880	0.46	J
ANTIMONY	0.64	0.64	R	0.34	0.34	R	1.4	1.3	J	0.29	0.29	R
ARSENIC	3.2	0.46	J	3.9	0.24	J	10.9	0.93	J	4.7	0.21	J
BARIUM	72.4	0.24	J	90.2	0.13	J	266	0.48	J	110	0.11	J
BERYLLIUM	0.01	0.01	J	0.16	0.0066	UJ	0.03	0.03	J	0.11	0.0057	UJ
CADMIUM	0.26	0.038	UJ	0.27	0.02	UJ	1.1	0.075	J	0.38	0.017	J
CALCIUM	19800	7.6	J	2540	4	J	99500	15.2	J	7250	3.4	J
CHROMIUM	12.9	0.11	J	12.4	0.059	J	20.6	0.23	J	23.3	0.051	J
COBALT	4.3	0.18	J	6	0.092	J	6.7	0.35	J	6.1	0.08	J
COPPER	17.4	0.15	J	12.2	0.079	J	73	0.3	J	13.3	0.068	J
IRON	11300	2.3	J	12300	1.2	J	24700	4.6	J	10700	1	J
LEAD	34.6	0.23	J	50.2	0.12	J	85	0.45	J	29.8	0.1	J
MAGNESIUM	5090	7.3	J	3440	3.8	J	14300	14.5	J	2670	3.3	J
MANGANESE	712	0.025	J	240	0.013	J	2480	0.05	J	285	0.011	J
MERCURY	0.11	0.11	U	0.05	0.05	U	0.2	0.2	U	0.05	0.05	U
MOLYBDENUM	0.42	0.19	J	0.1	0.1	J	4.5	0.38	J	0.09	0.09	J
NICKEL	16.2	0.16	J	15.5	0.086	J	31.2	0.33	J	23.9	0.074	J
POTASSIUM	1580	18.2	J	1670	9.6	J	3260	36.4	J	1160	8.3	J
SELENIUM	0.47	0.56	J	0.2	0.2	U	2.4	1.1		0.21	0.26	J
SILVER	0.17	0.16	UJ	0.09	0.09	U	0.58	0.33	J	0.09	0.074	UJ
SODIUM	4640	65.4		1380	34.4		39500	1310		133	29.7	J
THALLIUM	1.7	0.84	J	0.96	0.44	J	3.5	1.7	J	1.2	0.38	J
VANADIUM	22.8	0.19	J	24.5	0.099	J	37.2	0.38	J	25.2	0.085	J
ZINC	58.8	0.28	J	61.6	0.15	J	175	0.61	J	70.4	0.13	J

Notes:
U = not detected at d
J = estimated value

APPENDIX D-1

INORGANIC CHEMICALS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	SS211 6/8/1998 0.00 - 0.50			SS212 6/8/1998 0.00 - 0.50			SS213 6/8/1998 0.00 - 0.50			SS214 6/8/1998 0.00 - 0.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
ALUMINUM	7750	0.46	J	7920	0.43	J	8520	0.44	J	7080	0.41	J
ANTIMONY	0.29	0.29	R	0.6	0.27	J	0.28	0.28	R	0.44	0.26	J
ARSENIC	3.1	0.21	J	3.1	0.2	J	7.4	0.2	J	8.1	0.19	J
BARIUM	125	0.11	J	91.2	0.1	J	118	0.1	J	88.2	0.096	J
BERYLLIUM	0.17	0.0057	UJ	0.01	0.01	J	0.14	0.0054	UJ	0.01	0.0051	UJ
CADMIUM	0.25	0.017	UJ	0.36	0.016	J	0.69	0.016	J	0.38	0.015	J
CALCIUM	2690	3.4	J	3140	3.2	J	3100	3.3	J	2990	3.1	J
CHROMIUM	16.4	0.051	J	31.2	0.048	J	24.1	0.049	J	24	0.046	J
COBALT	5.4	0.08	J	8.5	0.075	J	6.1	0.076	J	7.3	0.071	J
COPPER	9.2	0.068	J	19.6	0.064	J	57.1	0.065	J	17.5	0.061	J
IRON	8580	1	J	14600	0.98	J	11900	0.98	J	11600	0.92	J
LEAD	44.5	0.1	J	56.3	0.096	J	110	0.097	J	195	0.091	J
MAGNESIUM	2650	3.3	J	4890	3.1	J	2510	3.1	J	4360	2.9	J
MANGANESE	233	0.011	J	383	0.011	J	251	0.011	J	311	0.01	J
MERCURY	0.04	0.04	U	0.05	0.05	U	0.25	0.045		0.08	0.055	UJ
MOLYBDENUM	0.09	0.09	J	0.08	0.08	J	0.08	0.08	J	0.1	0.076	J
NICKEL	20.4	0.074	J	39	0.07	J	48	0.07	J	37.9	0.066	J
POTASSIUM	537	8.2	J	608	7.8	J	1180	7.8	J	993	7.4	J
SELENIUM	0.18	0.18	U	0.17	0.17	U	0.17	0.17	U	0.17	0.23	J
SILVER	0.1	0.074	UJ	0.09	0.07	UJ	0.15	0.07	UJ	0.08	0.066	UJ
SODIUM	159	29.6	J	64	27.9	UJ	187	28.1	J	80.2	26.4	UJ
THALLIUM	0.94	0.38	J	1.2	0.36	J	0.81	0.36	J	0.83	0.34	J
VANADIUM	19.6	0.085	J	29.5	0.08	J	21	0.081	J	25.9	0.076	J
ZINC	46.5	0.12	J	104	0.12	J	337	1.2	J	79	0.11	J

Notes:
U = not detected at d
J = estimated value

APPENDIX D-2

SEMIVOLATILE ORGANIC COMPOUNDS AND TOTAL PETROLEUM HYDROCARBONS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location	SB001			SB003			SB004			SB009			SB010			SB011			SB012		
Sample Date	2/6/1996			2/6/1996			3/18/1997			3/18/1997			3/18/1997			3/18/1997			3/7/1997		
Sample Depth (ft.)	0.00 - 0.50			0.00 - 0.50			0.00 - 0.50			0.00 - 0.50			0.00 - 0.50			0.00 - 0.50			0.00 - 0.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
LOW MOLECULAR WEIGHT POLYCYCLIC AROMATIC HYDROCARBONS ([LMW PAH] UG/KG)																					
2-METHYLNAPHTHALENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
ACENAPHTHENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
ACENAPHTHYLENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
ANTHRACENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	UJ	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
FLUORENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
NAPHTHALENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	53.00	370.00	J	430.00	430.00	U	350.00	350.00	U
PHENANTHRENE	460.00	460.00	U	360.00	430.00	J	450.00	450.00	UJ	580.00	580.00	U	64.00	370.00	J	430.00	430.00	U	350.00	350.00	U
SUM LMW PAH	1840.00	5.00		2585.00	4.70		1800.00	4.30		2320.00	5.50		1461.00	3.60		1720.00	4.10		1400.00	3.20	
HIGH MOLECULAR WEIGHT POLYCYCLIC AROMATIC HYDROCARBONS ([HMW PAH] UG/KG)																					
BENZO(A)ANTHRACENE	460.00	460.00	U	480.00	430.00	J	450.00	450.00	UJ	580.00	580.00	UJ	370.00	370.00	U	430.00	430.00	UJ	350.00	350.00	UJ
BENZO(A)PYRENE	460.00	460.00	UJ	560.00	430.00	J	69.00	450.00	J	120.00	580.00	J	370.00	370.00	UJ	430.00	430.00	UJ	350.00	350.00	UJ
BENZO(B)FLUORANTHENE	460.00	460.00	UJ	1700.00	430.00	J	190.00	450.00	J	170.00	580.00	J	62.00	370.00	J	430.00	430.00	U	71.00	350.00	J
BENZO(G,H,I)PERYLENE	460.00	460.00	UJ	400.00	430.00	J	110.00	450.00	J	580.00	580.00	U	370.00	370.00	UJ	430.00	430.00	UJ	350.00	350.00	UJ
BENZO(K)FLUORANTHENE	460.00	460.00	UJ	2200.00	2200.00	UJ	49.00	450.00	J	580.00	580.00	U	370.00	370.00	UJ	430.00	4.10		350.00	350.00	UJ
CHRYSENE	460.00	460.00	U	1200.00	430.00	J	61.00	450.00	J	130.00	580.00	J	45.00	370.00	J	2150.00	4.10		54.00	350.00	J
DIBENZ(A,H)ANTHRACENE	460.00	460.00	UJ	2200.00	2200.00	UJ	450.00	450.00	UJ	580.00	580.00	U	370.00	370.00	UJ	430.00	430.00	U	350.00	350.00	UJ
FLUORANTHENE	460.00	460.00	U	580.00	430.00		70.00	450.00	J	160.00	580.00	J	51.00	370.00	J	210.00	210.00	U	77.00	350.00	J
INDENO(1,2,3-CD)PYRENE	460.00	460.00	UJ	350.00	430.00	J	80.00	450.00	J	580.00	580.00	U	370.00	370.00	UJ	210.00	210.00	U	350.00	350.00	UJ
PYRENE	460.00	460.00	U	1500.00	430.00	J	88.00	450.00	J	230.00	580.00	J	80.00	370.00	J	210.00	210.00	U	110.00	350.00	J
SUM HMW PAH	1840.00	5.00		22510.00	4.70	.	2601.00	4.30		3880.00	5.50		1639.00	3.60		430.00	430.00	U	1811.00	3.20	
TOTAL PAHS	3680.00	5.00		25095.00	4.70		4401.00	4.30		6200.00	5.50		3100.00	3.60		1100.00	1100.00	U	3211.00	3.20	
OTHER SEMIVOLATILE ORGANIC COMPOUNDS (UG/KG)																					
2-CHLORONAPHTHALENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
1,2,4-TRICHLOROBENZENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
1,2-DICHLOROBENZENE	460.00	460.00	U	430.00	430.00	U	220.00	220.00	U	280.00	280.00	U	180.00	180.00	U	430.00	430.00	U	170.00	170.00	U
1,3-DICHLOROBENZENE	460.00	460.00	U	430.00	430.00	U	220.00	220.00	U	280.00	280.00	U	180.00	180.00	U	430.00	430.00	U	170.00	170.00	U
1,4-DICHLOROBENZENE	460.00	460.00	U	430.00	430.00	U	220.00	220.00	U	280.00	280.00	U	180.00	180.00	U	1100.00	1100.00	U	170.00	170.00	U
2,2'-OXYBIS(1-CHLOROPROPANE)	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
2,4,5-TRICHLOROPHENOL	1100.00	1100.00	U	1000.00	1000.00	U	1100.00	1100.00	U	1500.00	1500.00	U	930.00	930.00	U	430.00	430.00	U	890.00	890.00	U
2,4,6-TRICHLOROPHENOL	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
2,4-DICHLOROPHENOL	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
2,4-DIMETHYLPHENOL	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	1100.00	1100.00	U	350.00	350.00	U
2,4-DINITROPHENOL	1100.00	1100.00	U	1000.00	1000.00	U	1100.00	1100.00	U	1500.00	1500.00	U	930.00	930.00	U	430.00	430.00	U	890.00	890.00	U
2,4-DINITROTOLUENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	UJ	350.00	350.00	U
2,6-DINITROTOLUENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	1100.00	1100.00	U	350.00	350.00	U
2-CHLOROPHENOL	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	1100.00	1100.00	U	350.00	350.00	U
2-METHYLPHENOL	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
2-NITROANILINE	1100.00	1100.00	U	1000.00	1000.00	U	1100.00	1100.00	U	1500.00	1500.00	U	930.00	930.00	U	430.00	430.00	U	890.00	890.00	U
2-NITROPHENOL	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
3,3'-DICHLOROBENZIDINE	460.00	460.00	UJ	2200.00	2200.00	UJ	450.00	450.00	UJ	580.00	580.00	UJ	370.00	370.00	U	430.00	430.00	U	350.00	350.00	UJ
3-NITROANILINE	1100.00	1100.00	U	1000.00	1000.00	U	1100.00	1100.00	U	1500.00	1500.00	U	930.00	930.00	U	430.00	430.00	U	890.00	890.00	U
4,6-DINITRO-2-METHYLPHENOL	1100.00	1100.00	U	1000.00	1000.00	U	1100.00	1100.00	UJ	1500.00	1500.00	U	930.00	930.00	U	1100.00	1100.00	U	890.00	890.00	U
4-BROMOPHENYL-PHENYLETHER	460.00	460.00	U	430.00	430.00	U	450.00	450.00	UJ	580.00	580.00	U	370.00	370.00	U	1100.00	1100.00	U	350.00	350.00	U
4-CHLORO-3-METHYLPHENOL	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
4-CHLOROANILINE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U

APPENDIX D-2

SEMIVOLATILE ORGANIC COMPOUNDS AND TOTAL PETROLEUM HYDROCARBONS
TAYLOR BOULEVARD BRIDGE DISPOSAL SITE
NAVAL WEAPONS STATION SEAL BEACH, DETACHMENT CONCORD

Sample Location Sample Date Sample Depth (ft.)	SB001 2/6/1996 0.00 - 0.50			SB003 2/6/1996 0.00 - 0.50			SB004 3/18/1997 0.00 - 0.50			SB009 3/18/1997 0.00 - 0.50			SB010 3/18/1997 0.00 - 0.50			SB011 3/18/1997 0.00 - 0.50			SB012 3/7/1997 0.00 - 0.50		
Analyte	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.	Result	Det. Lim.	Qual.
4-CHLOROPHENYL-PHENYLETHER	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	170.00	170.00	UJ	350.00	350.00	U
4-METHYLPHENOL	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	UJ	350.00	350.00	U
4-NITROANILINE	1100.00	1100.00	U	1000.00	1000.00	U	1100.00	1100.00	U	1500.00	1500.00	U	930.00	930.00	U	430.00	430.00	U	890.00	890.00	U
4-NITROPHENOL	1100.00	1100.00	U	1000.00	1000.00	U	1100.00	1100.00	U	1500.00	1500.00	U	930.00	930.00	U	430.00	430.00	U	890.00	890.00	U
BIS(2-CHLOROETHOXY)METHANE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
BIS(2-CHLOROETHYL)ETHER	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
BIS(2-ETHYLHEXYL)PHTHALATE	460.00	460.00	U	2200.00	2200.00	U	620.00	450.00	UJ	230.00	230.00	UJ	150.00	150.00	U	430.00	430.00	U	140.00	140.00	UJ
BUTYLBENZYLPHTHALATE	460.00	460.00	U	2200.00	2200.00	U	450.00	450.00	UJ	580.00	580.00	UJ	370.00	370.00	U	430.00	430.00	U	350.00	350.00	UJ
CARBAZOLE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	UJ	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
DI-N-BUTYLPHTHALATE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
DI-N-OCTYLPHTHALATE	460.00	460.00	UJ	2200.00	2200.00	UJ	450.00	450.00	UJ	580.00	580.00	U	370.00	370.00	UJ	430.00	430.00	U	350.00	350.00	UJ
DIBENZOFURAN	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
DIETHYLPHTHALATE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
DIMETHYLPHTHALATE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
HEXACHLOROBENZENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	UJ	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
HEXACHLOROBUTADIENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	1100.00	1100.00	U	350.00	350.00	U
HEXACHLOROCYCLOPENTADIENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	430.00	430.00	U	350.00	350.00	U
HEXACHLOROETHANE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	NA	NA	NA	350.00	350.00	U
ISOPHORONE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	NA	NA	NA	350.00	350.00	U
N-NITROSO-DI-N-PROPYLAMINE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	NA	NA	NA	350.00	350.00	U
N-NITROSODIPHENYLAMINE (1)	460.00	460.00	U	430.00	430.00	U	450.00	450.00	UJ	580.00	580.00	U	370.00	370.00	U	NA	NA	NA	350.00	350.00	U
NITROBENZENE	460.00	460.00	U	430.00	430.00	U	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	NA	NA	NA	350.00	350.00	U
PENTACHLOROPHENOL	1100.00	1100.00	U	1000.00	1000.00	U	1100.00	1100.00	UJ	1500.00	1500.00	U	930.00	930.00	U	NA	NA	NA	890.00	890.00	U
PHENOL	460.00	460.00	U	410.00	430.00	J	450.00	450.00	U	580.00	580.00	U	370.00	370.00	U	NA	NA	NA	350.00	350.00	U
TOTAL PETROLEUM HYDROCARBONS (MG/KG)																					
DIESEL (EXTRACTABLE)	33.00	35.00	J	550.00	260.00		140.00	140.00	U	180.00	180.00	U	56.00	56.00	U	13.00	13.00	U	11.00	11.00	U
MOTOR OIL (EXTRACTABLE)	240.00	35.00		2900.00	260.00		1300.00	135.00		1700.00	180.00		190.00	56.00		93.00	13.00		140.00	11.00	
GASOLINE (PURGEABLE)	0.70	0.70	UJ	0.65	0.65	UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

U = Not detected with detection limit indicated

J = Estimated value

Blank = Value above detection limit

NA = not analyzed

Reviewed By:

Date:

***Eohaustorius estuarius* Data Validation**

	Sample IDs		
Criteria	**309SSNS**	**309SSCS**	**309SSSS**
Amphipod size range 3 to 5 mm	Yes	Yes	Yes
<5% amphipod mortality during transport	Not noted	Not noted	Not noted
Mean (of 5) control survival $\geq$ 90% at end	Yes	Yes	Yes
Reference toxicant for each batch of organisms	Yes	Yes	Yes
$EC_{50} \pm 2$ SD of expected mean for reference toxicant	Yes	Yes	Yes
• Swimming behavior observed	Not noted	Not noted	Not noted
• Full digestive tracts observed	Not noted	Not noted	Not noted
• Gray or yellow/white color on receipt	Not noted	Not noted	Not noted
Amphipods collected at the same location	Yes	Yes	Yes
Salinity acclimation ≤ 5ppt/day	Yes	Yes	Yes
Temperature acclimation ≤ 3°C/day	Not noted	Not noted	Not noted
Test begun w/in 10 days of amphipod receipt	Yes	Yes	Yes
Test begun w/in 14 days of sediment receipt	Yes	Yes	Yes
Samples examined for indigenous organisms	Not noted	Not noted	Not noted
Overlying Water			
• Temperature 15±2°C (daily)	15.5 – 17.5	15.5 – 17.2	15.5 – 17.3
• Salinity = 20 ± 2ppt (daily)	19.3 – 20.7	19.4 – 21.0	19.9 – 21.9
• pH (daily)	8.02 – 9.40	8.02 – 9.13	8.02 – 9.29
Total $NH_3 \leq$ 60 mg/L (day 2/8)[1]	4.14 / 1.15	3.70 / 1.42	2.96 / 0.16
Un-ionized $NH_3 \leq$ 0.8 mg/L (day 2/8)[1]	Not noted	Not noted	Not noted
• DO ≥ 7.7 mg/L (≥ 90% saturation @ start & end)	8.2 – 9.5	7.8 – 9.2	7.7 – 9.6
Total sulfide < 1.22 mg/L @ pH=8.0[2]	Not noted	Not noted	Not noted
Pore Water ˜ Initial			
Salinity (ppt)	30.0	22.3	22.4
pH	7.66	7.98	7.83
Total NH_3 (mg/L)	26.4	19.5	17.7
Un-ionized NH_3 (mg/L)	Not noted	Not noted	Not noted
Sulfide (mg/L)	31.0	11.1	1.08
Comments			
Qualifier			

Notes:

[1] (U.S. EPA. 1994). Ammonia limits at pH = 7.7.

[2] (Knezovich and others 1996). No effect concentration

REFERENCES

Knezovich, J.P., D.J. Steichen, J.A. Jelinski, and S.L. Anderson. 1996. "Sulfide Tolerance of Four Marine Species Used to Evaluate Sediment and Pore-Water Toxicity." *Bulletin of Environmental Contamination and Toxicology*. Volume 57. Pages 450-457.

U.S. Environmental Protection Agency (EPA). 1994. "Methods for Assessing the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods." EPA/600/R-94/025. June.

APPENDIX E

ESTIMATION OF AMBIENT METAL CONCENTRATIONS IN THE TIDAL AREA SOILS

CONTENTS

FIGURES

TABLES

1.0 INTRODUCTION

This technical memorandum, prepared by PRC Environmental Management, Inc. (PRC), presents the approach for estimating ambient metal concentration limits in Tidal Area soils at Naval Weapons Station (NWS) Concord, California (Figure 1). The estimated ambient concentration limits are intended for use in the baseline human health risk assessment, ecological risk assessment, and remedial investigation (RI) of NWS Concord Installation Restoration Program sites.

Naturally occurring concentrations of metals in soil, rock, and water are usually referred to as "background" concentrations. To evaluate the effects of site activities on the environment, constituent concentrations found at a site are typically compared to the background concentrations, and the difference between the site and background concentrations is assumed to be the impact of site activities.

In some cases, land development activities that are not associated with the specific Installation Restoration Program site activities being assessed may have resulted in relatively uniform changes to the original background concentrations. These concentrations represent conditions that existed before potential impacts from site-specific activities and will be referred to as "ambient" concentrations.

Because of the proximity of potential contamination sources, such as chemical plants, undisturbed or "true" background conditions are unlikely to occur within or near the Tidal Area. Efforts to identify a background or reference area upgradient from the Tidal Area sites have not been successful. U.S. Environmental Protection Agency (EPA) collected samples from two areas southwest of the Tidal Area sites in an attempt to identify a representative background site. Soil samples from the first area contained elevated levels of metals, specifically lead. Soil and water samples collected from an area farther inland than the first area also contained elevated levels of metals. In addition, petroleum hydrocarbons were observed in shallow soils. Consequently, EPA abandoned this second location. Therefore, in the absence of locations with background conditions within the Tidal Area or adjacent to it, the approach presented in this memorandum entails use of the site-specific soil metals data collected for the RI to estimate upper limits for ambient concentrations.

This document describes the approach, conceptual model, and statistical analysis used in estimating ambient metal concentrations of the Tidal Area soils. The results of the estimation are summarized in Table E-1 and Figures 3 through 19.

2.0 APPROACH

A step-by-step approach for estimating ambient metal concentration limits is defined as follows:

Step 1. Develop a conceptual model of soils in the Tidal Area and select the RI soil samples to be used in the estimation.

Step 2. Query the database of RI soil analytical results for all metals except essential nutrients. Exclude from the data set the soil samples that may have been affected by site activities.

Step 3. For metals with high detection frequencies, substitute values of one-half the sample quantitation limit (SQL) for all analytical results reported as not detected. For metals with low detection frequencies, replace not detected values with the lowest detected values. Use probability plots to explore the data and exclude outliers from the metal data sets. Test the distribution of the resulting ambient data sets.

Step 4. Use nonparametric formula to estimate the ambient limit as the 95th or 99th percentile of the metal data set.

3.0 CONCEPTUAL MODEL

The conceptual model developed for this task is a generalized representation of soil conditions and was used to justify the selection of the RI soil samples in estimating ambient limits for inorganic constituents. The model is based on a characterization of the Tidal Area subsurface materials and preliminary analysis of the grain size distribution in soil samples from the four sites.

Subsurface geology of the Tidal Area is best described as a zone of interfingering alluvial and estuarine depositional environments. The Tidal Area is divided into three distinct landforms, all of Quaternary age:

foot slopes, flood plains, and marsh or wetlands (Figure 2). The four Tidal Area sites (IR sites 1, 2, 9, and 11) are located within the wetlands adjacent to Suisun Bay and underlain by fine grained silt and clay mixed with organic material that make up bay muds (Lee et al. 1986).

These bay muds have been divided into Younger Bay Mud and Older Bay Mud (McCulley, Frick and Gilman, Inc. 1987). Soil borings drilled at the four Tidal Area sites are confined to the Younger Bay Mud stratigraphic unit. The Younger Bay Mud is an estuarine/marine silty clay that is commonly compacted stiff to semi-hard, and varies in thickness from 15 to 50 feet. Sand lenses occur in the Younger Bay Mud and may represent historic streambeds or outwash deposits. Mineral compositions of bay muds consist of mica, montmorillinite, chlorite, kaolinite, quartz, and feldspar (Goldman 1969).

Soils beneath the four Tidal Area sites are composed of silty, and locally sandy, clay. Silty, fine grained sand lenses were observed in a few soil borings, but the lenses can not be correlated between soil borings (IT Corp. 1992). Based upon a preliminary analysis of the grain size distribution in soil samples collected from the sites during the remedial investigation, the fraction of silt and clay in subsurface materials tends to increase with depth; the sediments with highest ratios of coarse to fine materials arc generally confined to the upper 0.5 feet below ground surface (bgs). Due to a general decrease in permeability and an increase in the sorptive properties of soils with depth, the leaching of metals downward from potentially affected surface soils is expected to be limited. Thus, the concentrations of metals at depths greater than 0.5 feet bgs are expected to represent ambient conditions.

Statistical analysis of data on nineteen metals (excluding essential nutrients) from over 200 RI soil samples collected at the four sites has shown that some metals (aluminum, arsenic, chromium, nickel, and vanadium) have similar concentrations regardless of the depth of the sample. However, many other metals exhibit higher concentrations in the surface soils than deep soils. For example, lead concentrations in shallow samples (up to 0.5 feet deep) are, on average, three times higher than in deep samples. Mercury and zinc concentrations in the surface soils are almost twice as high as in the deeper deposits. Using statistical comparisons with t-test and K-S test (Gilbert 1987), the statistically significant differences in concentrations versus depth were confirmed for antimony, barium, cobalt, copper, lead, manganese, mercury, molybdenum, and zinc.

The consistency of concentrations at different depths and relatively narrow ranges of concentrations of aluminum, arsenic, chromium, nickel, and vanadium suggests they may be naturally occurring. The ranges of concentrations of arsenic, chromium, and nickel observed in the soils in the Tidal Area are comparable with the reported concentrations in the Suisun Bay sediments (San Francisco Estuary Institute 1994).

The elevated concentrations of lead, mercury, zinc, antimony, and copper in the uppermost soils may be related to both natural factors and the potential contamination sources. Relatively high levels of lead of about 200 milligrams per kilogram (mg/kg) in the upper 0.5 feet of soils may be related to potential contamination releases from surrounding chemical plants. The occurrence of elevated mercury in the uppermost soils is likely attributable to the erosion and deposition of mineralized source materials from Los Medanos Hills. Further, there has been mining activity on the western slope of the Sierra Nevada mountain range since the late 1800s that may have indirectly contributed to accumulation of some metals (iron, copper, and lead) in soils of the Tidal Area. Under this hypothesis, metals dissolved by acid mine drainage or bound to particulates were transported via surface water to the Sacramento/San Joaquin river delta, and ultimately deposited in the Bay. Similarly, some metal compounds might have been deposited directly on the surface within the Tidal Area due to its flooding during high tides.

Because it is difficult to distinguish the influence of natural and anthropogenic factors on concentrations of metals encountered in the uppermost soils of the Tidal Area, the evaluation of ambient metal limits is conducted using subsurface soil samples only. These subsurface soil samples used in the evaluation were collected between one and ten feet below ground surface.

Ambient metal concentration limits were estimated for all the metals available in the database of RI soil analytical results, excluding sodium, potassium, calcium, magnesium, and iron which are essential nutrients. Several soil samples (from IR sites 1, 2, and 11) expected to be potentially affected by site activities have been excluded from the metal data sets before the evaluation. The size of the resulting data sets was in the order of 60 values (Table E-1), which is sufficient to allow estimation of ambient limits using statistical methods that are discussed below.

4.0 ESTIMATION METHODOLOGY

Statistical procedures consistent with U.S. Environmental Protection Agency (EPA) and Department of Toxic Substances Control (DTSC) guidance documents (EPA 1989; DTSC 1992, 1994, 1997) and current practices in the environmental industry were used to establish ambient concentrations of metals in soils. When defining a reasonable upper level of the ambient concentrations of metals in Tidal area soils, the 95th percentile of the distribution was used. The 95th percentile was calculated for each metal data set using nonparametric formula (Gilbert 1997). Because the 95th percentile provides a conservative (low) estimate of the upper ambient limit, the 99th percentile was also calculated for each metal. For data sets with less than 100 values, the nonparametric estimate of the 99th percentile exceeds the maximum value in a data set. Therefore, a maximum value in a metal data set was used as a less conservative upper limit of ambient metal concentrations.

The following sections describe briefly the statistical methods that are used to estimate ambient concentration limits for soil metals. A more detailed description of specific procedures used in the estimation may be found in the Technical Memorandum on Estimation of Ambient Metal Concentrations in Soils prepared for Mare Island Naval Shipyard in December 1995.

4.1 DATA SET PREPARATION

Before ambient metal concentrations can be estimated, most of the data sets required special preparation. Preparation procedures included steps to account for the analytical results reported as not detected and transformation of the data to approximate normal distributions.

Not detected results must be treated the same way in the ambient evaluation and in the risk assessment. In consultation with regulatory agencies, however, and based on DTSC guidance (DTSC 1997), the following procedure was used. For metals with high detection frequency (greater than 50 percent) that included aluminum, barium, chromium, cobalt, copper, lead, manganese, nickel, vanadium, and zinc a value of one-half the sample quantitation limit (SQL) for all analytical results reported as not detected. For metals with low detection frequencies (less than 50 percent), the not detected results were replaced with the lowest detected values. This group of metals included antimony, arsenic, beryllium, cadmium, mercury, molybdenum, selenium, silver, and thallium (Table E-1). Arsenic was included in this group of metals at the request of the DTCS although arsenic has a high detection frequency (51 detections of 61 samples analyzed). The selenium and silver data sets almost entirely consist of not detected results.

To evaluate whether it was necessary to transform a specific data set to logarithms to approximate a normal distribution, summary statistics, including the mean, standard deviation, coefficient of variation, skewness, and kurtosis were calculated. In particular, the values of skewness and kurtosis were useful indicators of the need for data set transformation.

Following transformation, if necessary, a working set of histograms and probability plots was built with Geo-EAS geostatistical software (EPA 1991) for interim graphical analysis. These figures were reviewed to evaluate the effectiveness of the data transformations applied, and to identify anomalously high metal concentrations or outliers. These outliers are likely to be associated with site activities and were excluded from ambient data sets as described below.

4.2 EXCLUSION OF OUTLIERS

In performing frequency distribution analysis, a few metal concentration data points may be found at concentrations significantly greater than the main population. These outliers can be initially identified on histograms and probability plots, but more rigorously are defined as concentrations greater than three times the standard deviation from the mean. The outliers are generally attributed to site activities and are excluded from the data sets. It should be noted that since the data points considered as outliers may also represent extreme values of actual ambient concentrations, their exclusion may lead to conservative (low) estimates of ambient limits. The simultaneous exclusion of anomalously low or not detected values from some data sets may partially compensate for this bias.

4.3 CALCULATION OF AMBIENT METAL CONCENTRATION LIMITS

After making final adjustments to the ambient data sets as described above, a probability plot is prepared for each metal of interest to confirm the effectiveness of the preparation procedures and to proceed with calculation of ambient limits. To estimate upper limit of ambient concentrations for a particular metal, the 95th percentile of the distribution is calculated using a step-by-step procedure (Gilbert 1987) as follows:

Step 1. Rank the data from minimum to maximum to obtain the sample order statistics:

$$x_1 \leq x_2 \leq \ldots \leq x_l \ldots \leq x_n$$

Step 2. Calculate l:

$$l = p\ (n + 1)$$

Where

p = 0.95

n = number of values in the ambient data set

Step 3. If the calculated l is an integer, then the 95th percentile is the lth largest datum (among the ranked concentrations) in the data set. If l is not an integer, estimate the 95th percentile by linear interpolation between the two concentrations closest to l.

The 99th percentile is estimated in the same way using $p = 0.99$. For data sets with less than 100 values, the calculated l exceeds the largest datum in the data set. Therefore, the 99th percentile is estimated as the maximum value in the data set.

5.0 SUMMARY OF FINDINGS

The ambient concentration limits estimated for metals in the Tidal Area soils through the procedures described above are presented in Table E-1. The table includes PRGs (EPA 1996) for comparison purposes. The estimated ambient limits for arsenic and beryllium exceeded this criterion, as indicated in Table E-1 by asterisks.

The probability plots that support the estimations are attached as Figures 3 through 19. The plots include only the data points that remained in the data set after thc exclusion of outliers; the number of data points used corresponds to the data set size column shown in Tables 1. The plots also provide summary statistics including the mean, standard deviation, coefficient of variation, skewness, and kurtosis. The type of underlying data set distribution (normal, lognormal, and nonparametric) is also noted.

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FIGURES

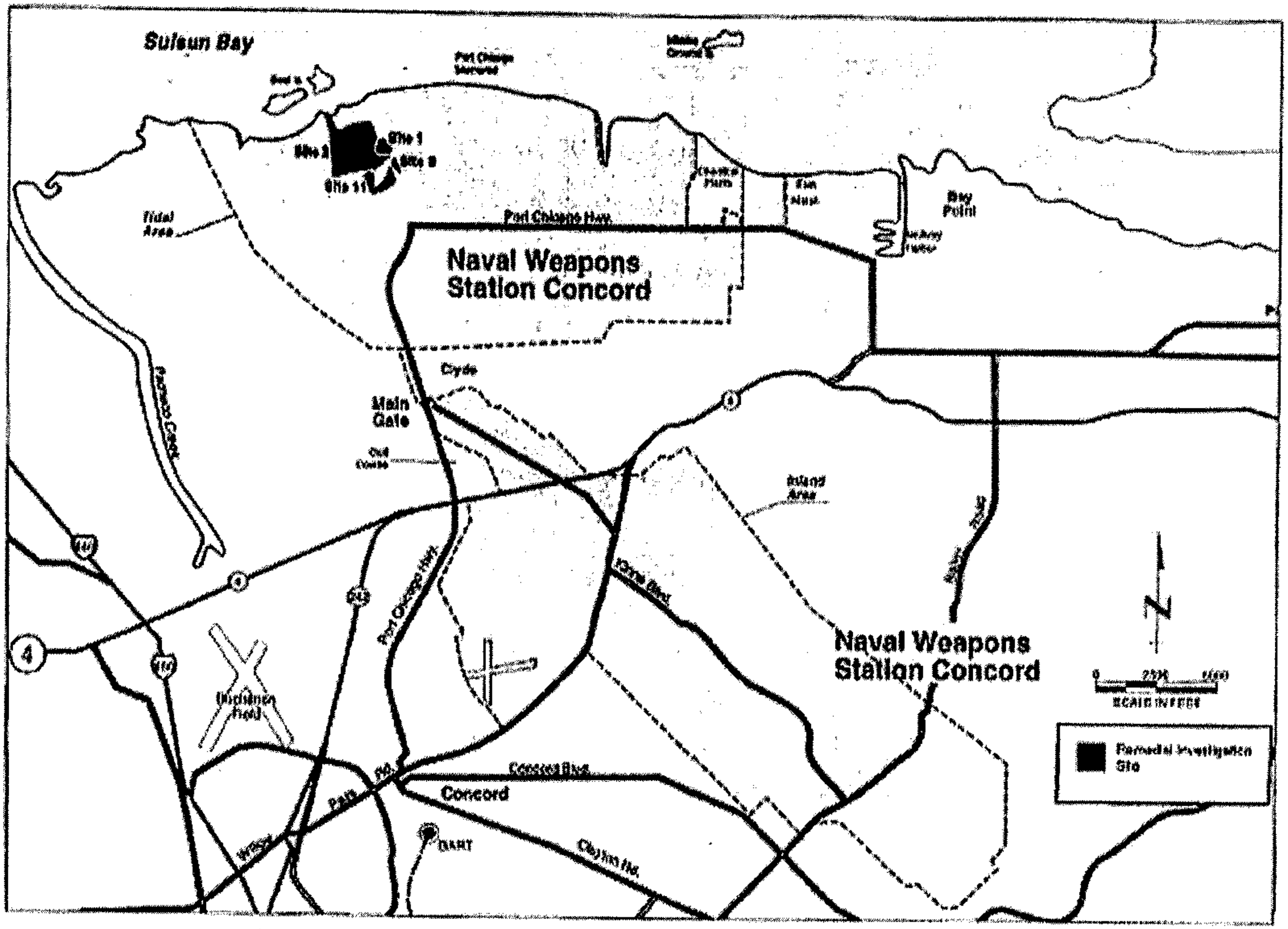
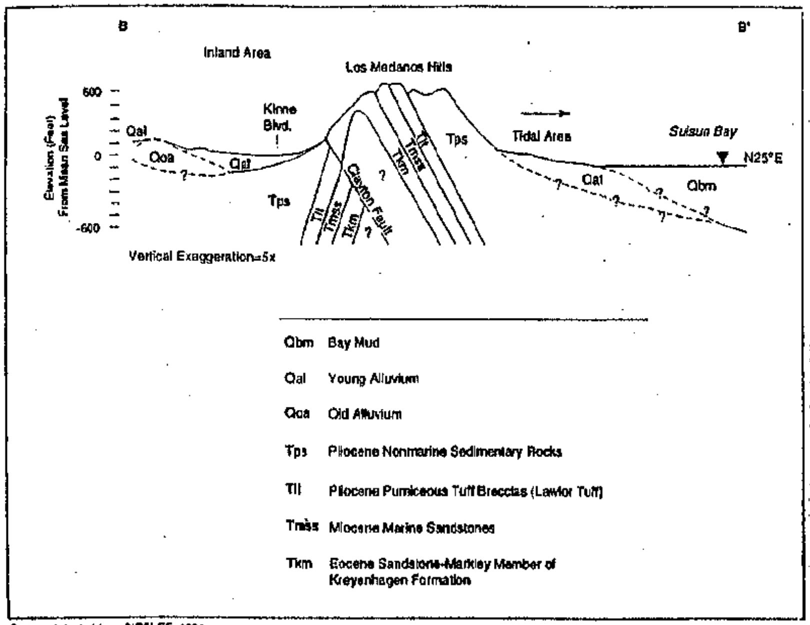
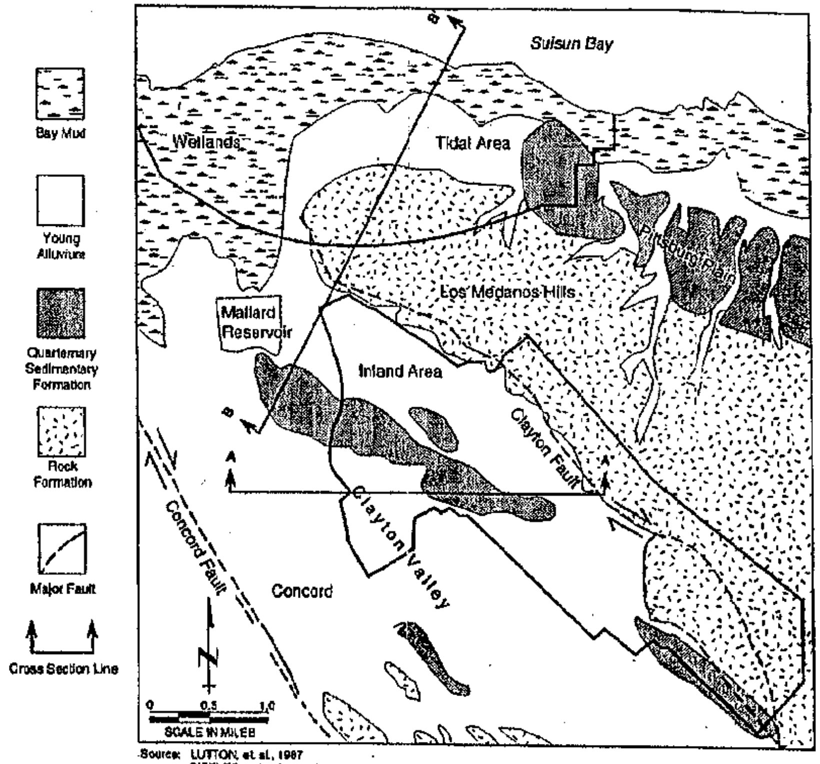


FIGURE 1
TIDAL AREA INVESTIGATION SITES
NAVAL WEAPONS STATION CONCORD

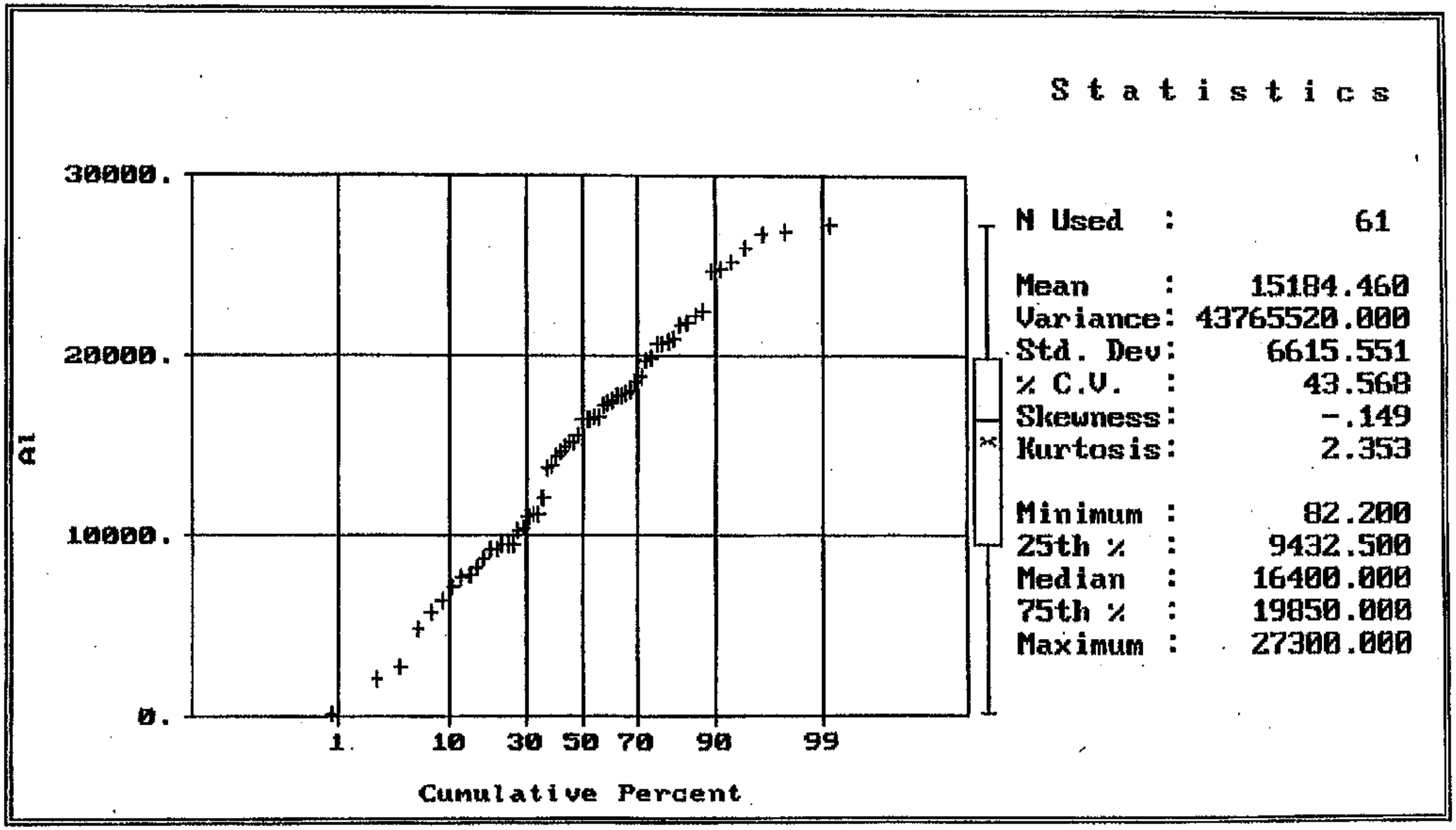


Source: Adapted from DIBBLEE, 1981



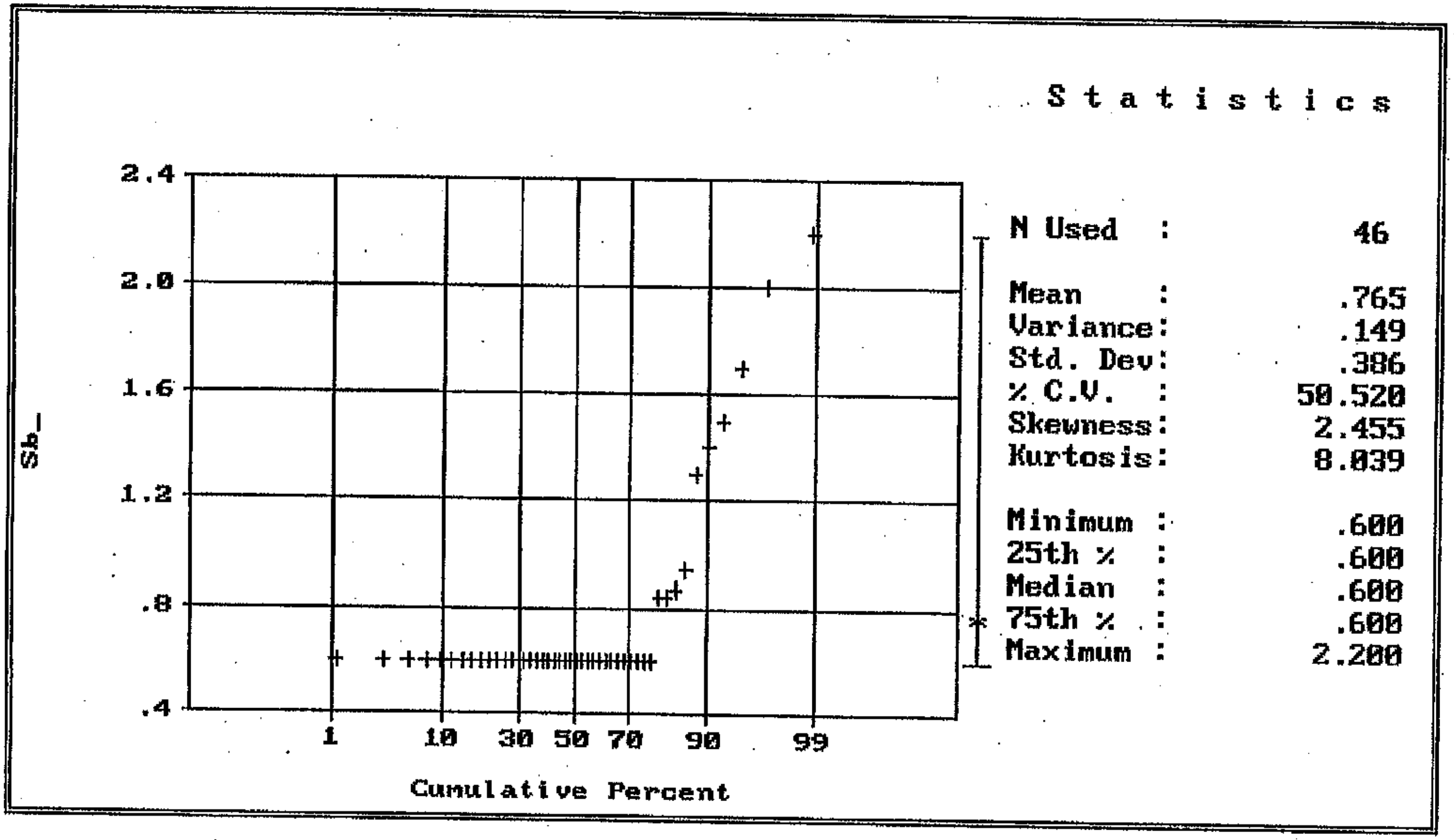
Source: LUTTON, et al, 1987
DIBBLEE, 1980a,b,c, 1981

FIGURE 2
GEOLOGIC MAP
NAVAL WEAPONS
STATION CONCORD



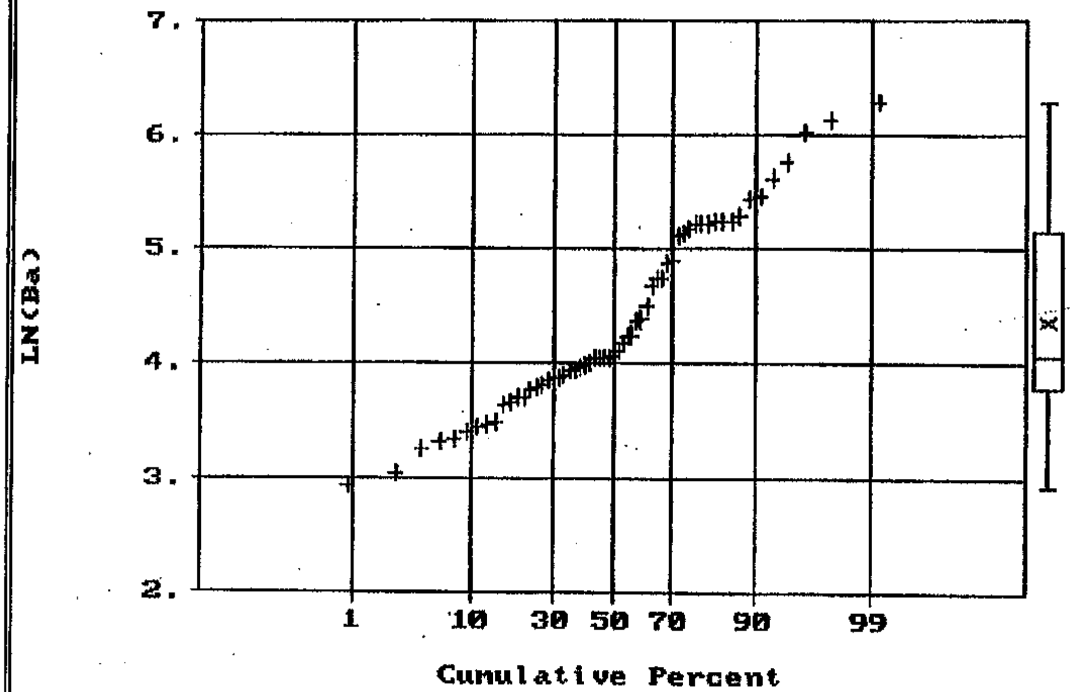
Note: The data set distribution is normal.

FIGURE 3
PROBABILITY PLOT OF ALUMINUM CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



Note: The data set distribution is nonparametric.

FIGURE 4
PROBABILITY PLOT OF ANTIMONY CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD

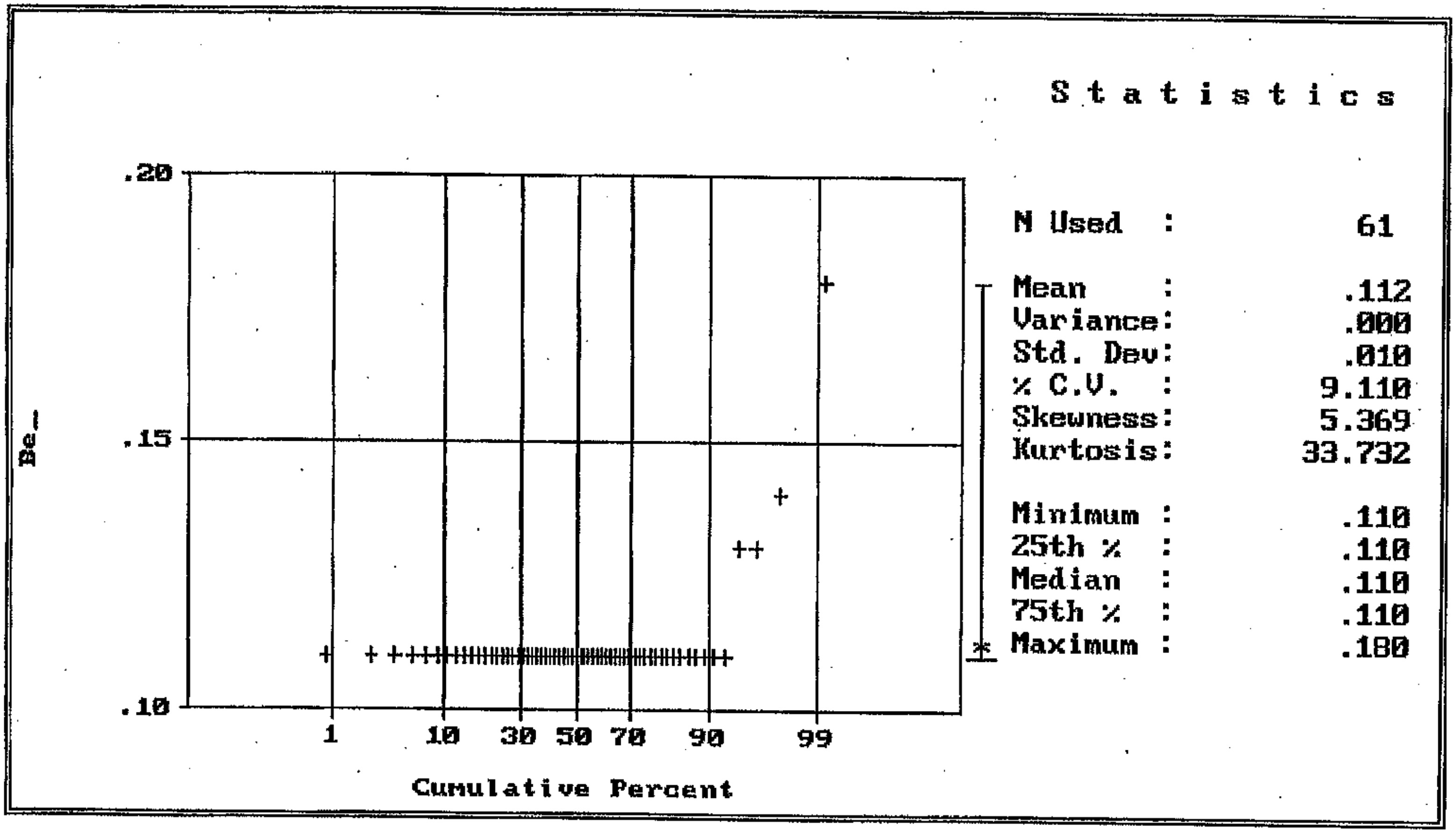


Statistics

N Used	:	59
Mean	:	4.376
Variance	:	.677
Std. Dev	:	.823
% C.V.	:	18.807
Skewness	:	.455
Kurtosis	:	2.298
Minimum	:	2.918
25th %	:	3.781
Median	:	4.074
75th %	:	5.146
Maximum	:	6.271

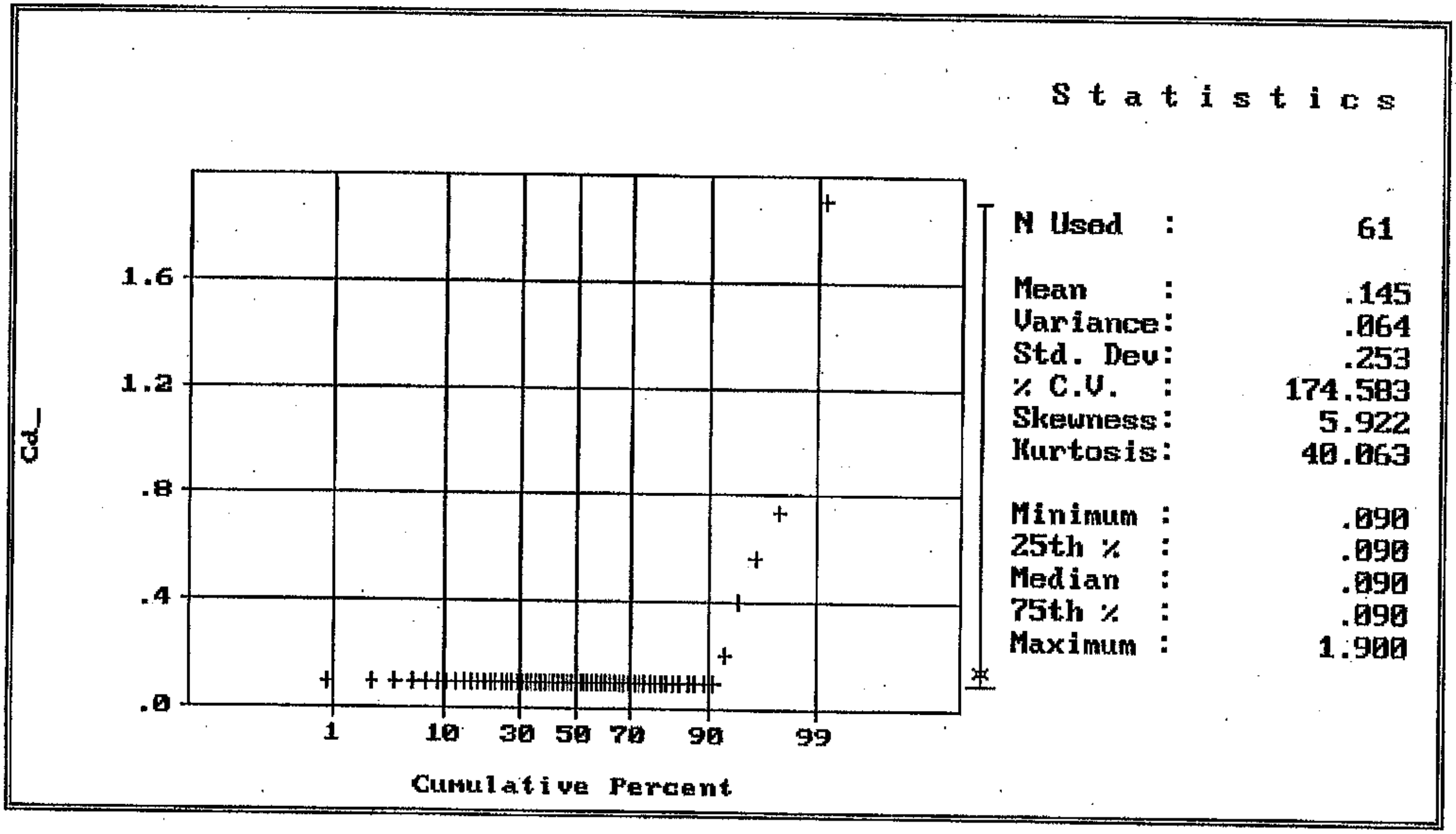
Note: The data set distribution is lognormal.

FIGURE 6
PROBABILITY PLOT OF BARIUM CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



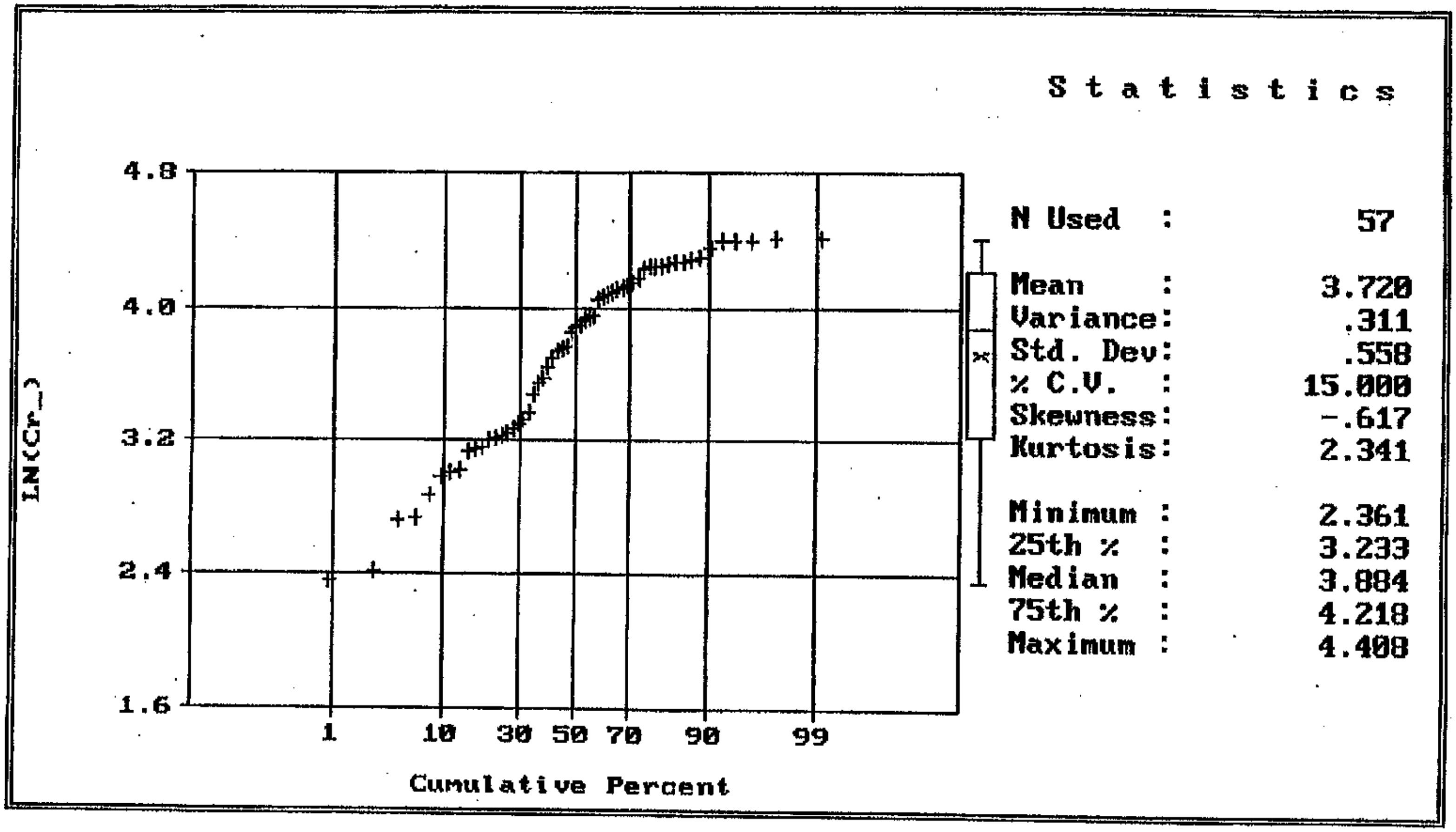
Note: The data set distribution is nonparametric.

FIGURE 7
PROBABILITY PLOT OF BERYLLIUM CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



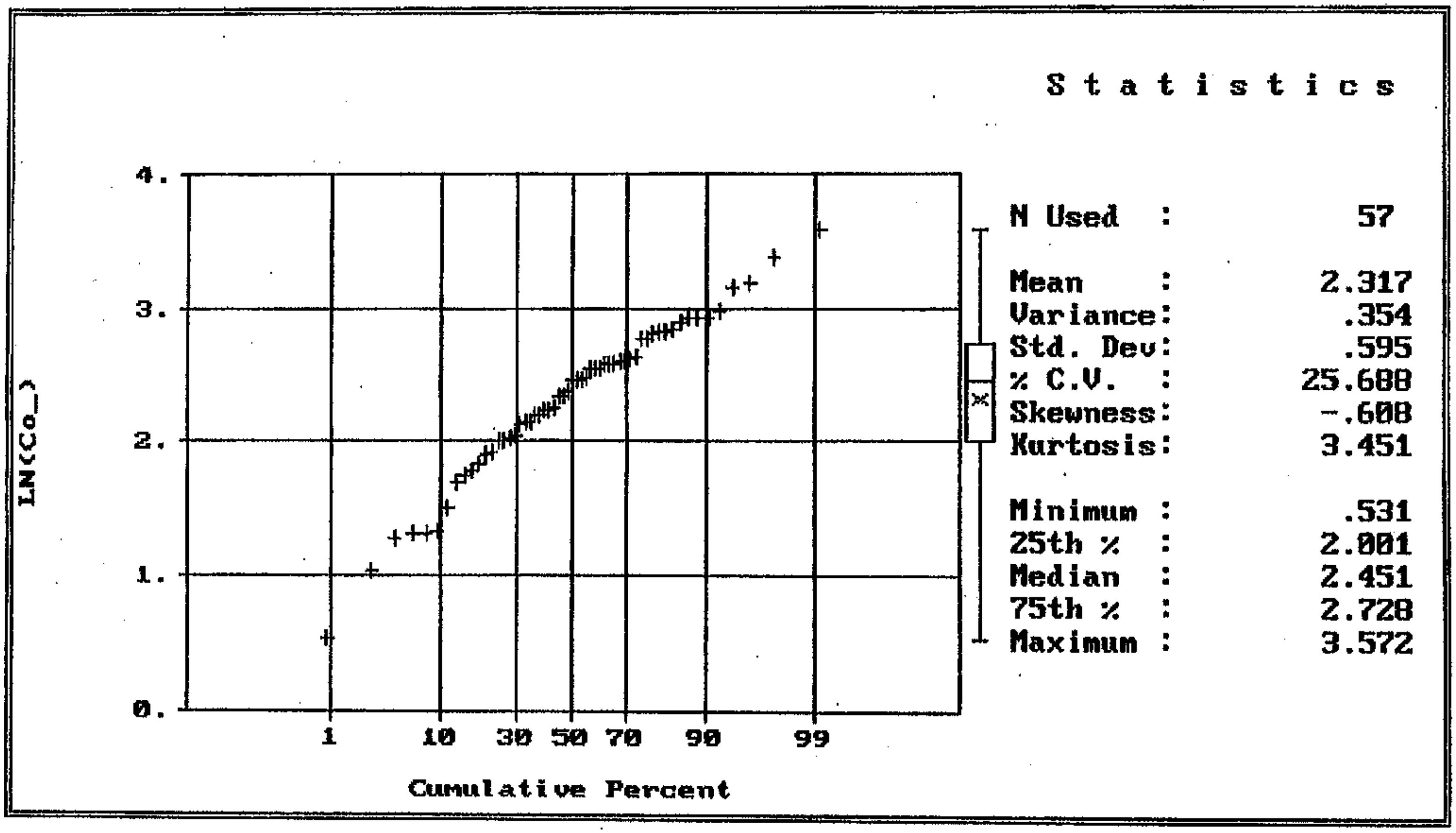
Note: The data set distribution is nonparametric.

FIGURE 8
PROBABILITY PLOT OF CADMIUM CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



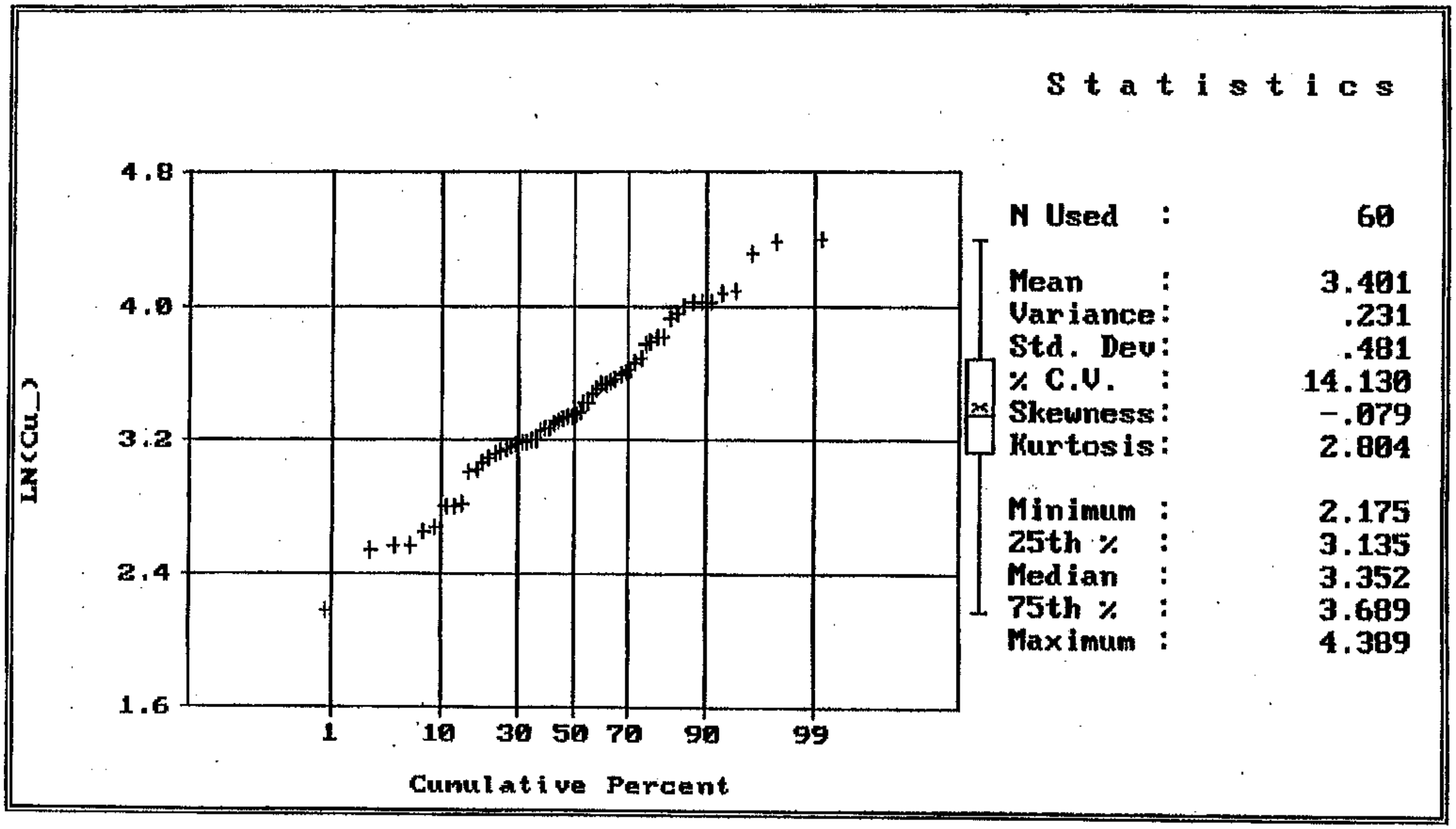
Note: The data set distribution is lognormal.

FIGURE 9
PROBABILITY PLOT OF CHROMIUM CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



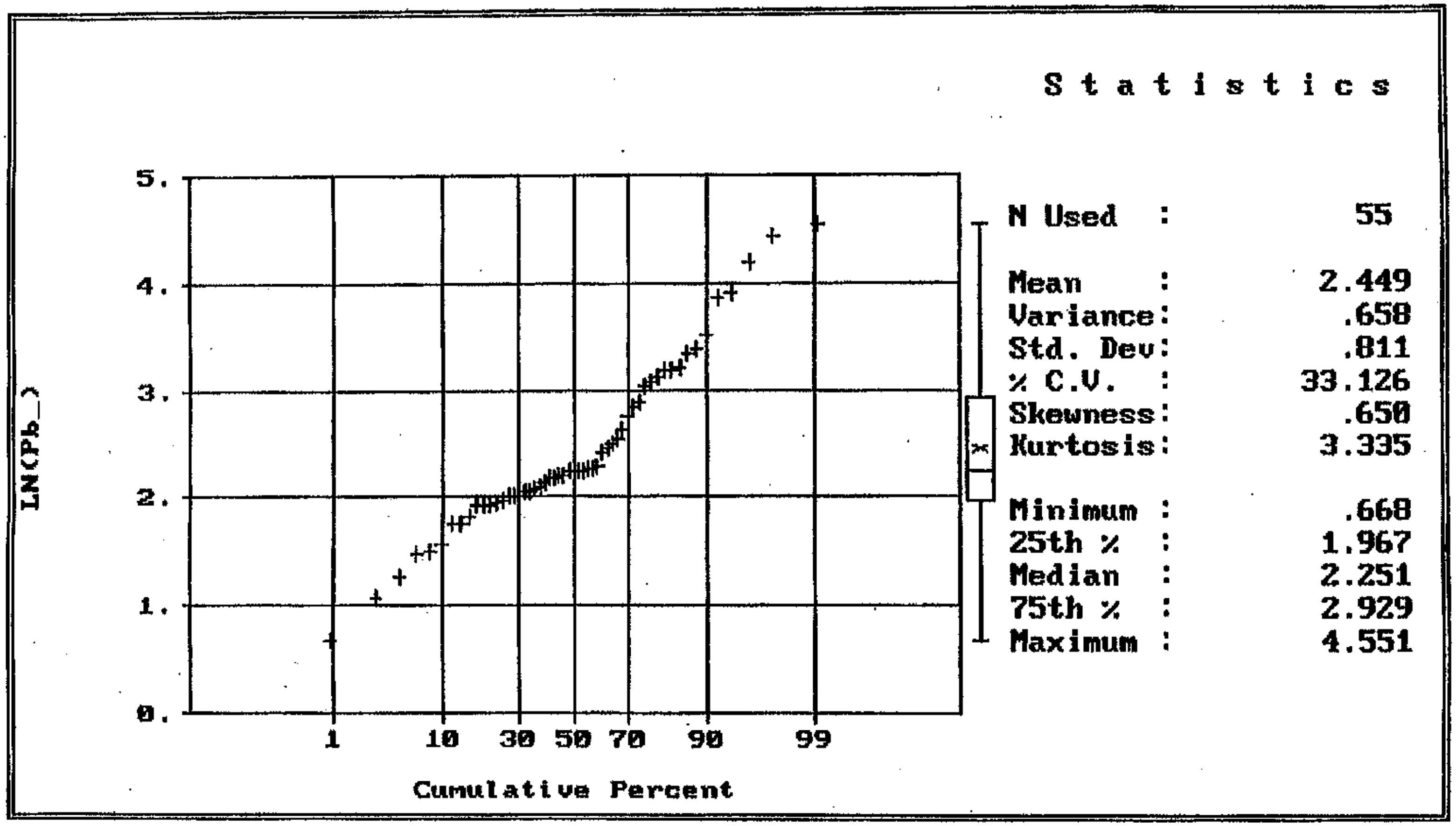
Note: The data set distribution is lognormal.

FIGURE 10
PROBABILITY PLOT OF COBALT CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



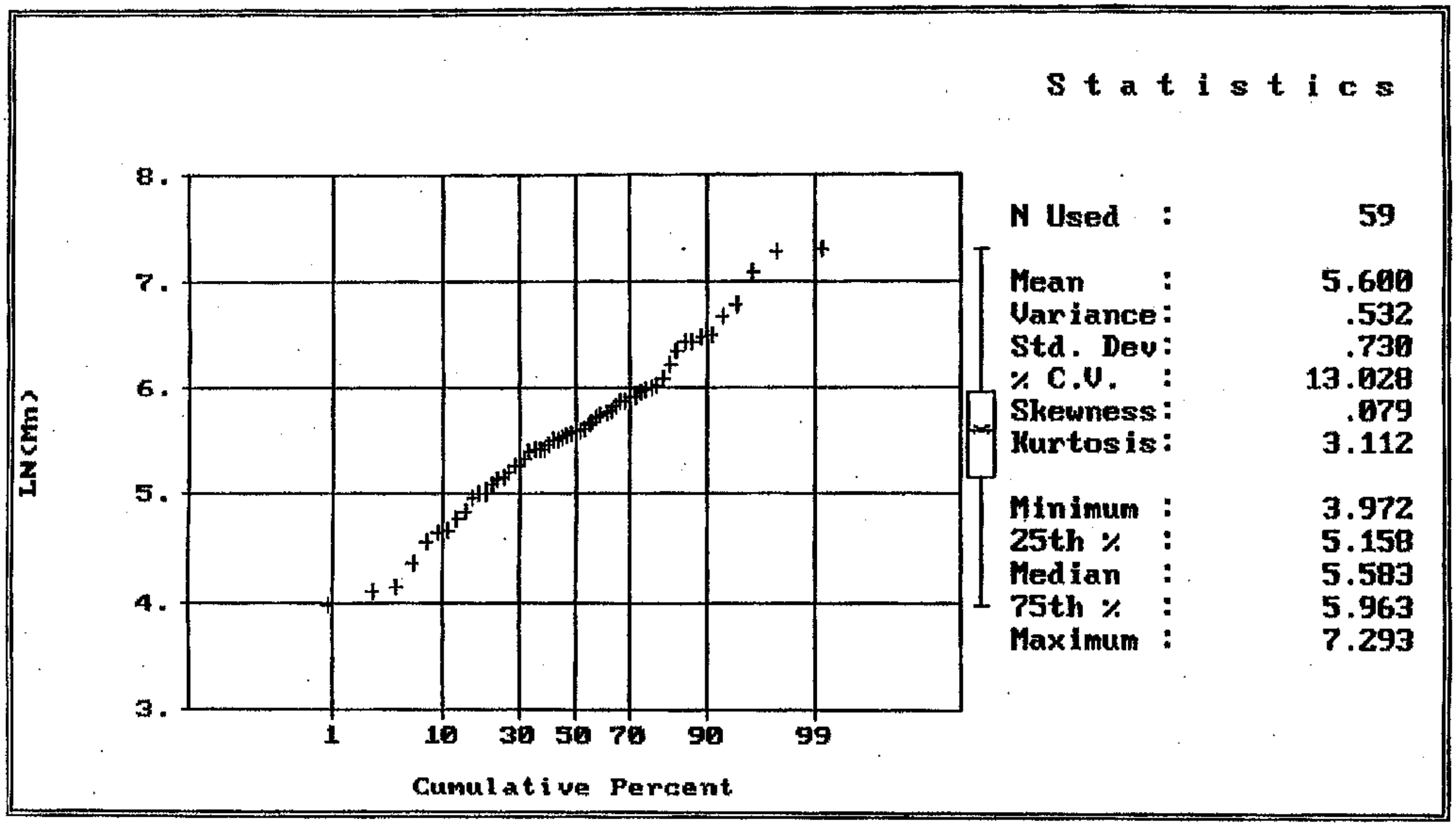
Note: The data set distribution is lognormal.

FIGURE 11
PROBABILITY PLOT OF COPPER CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



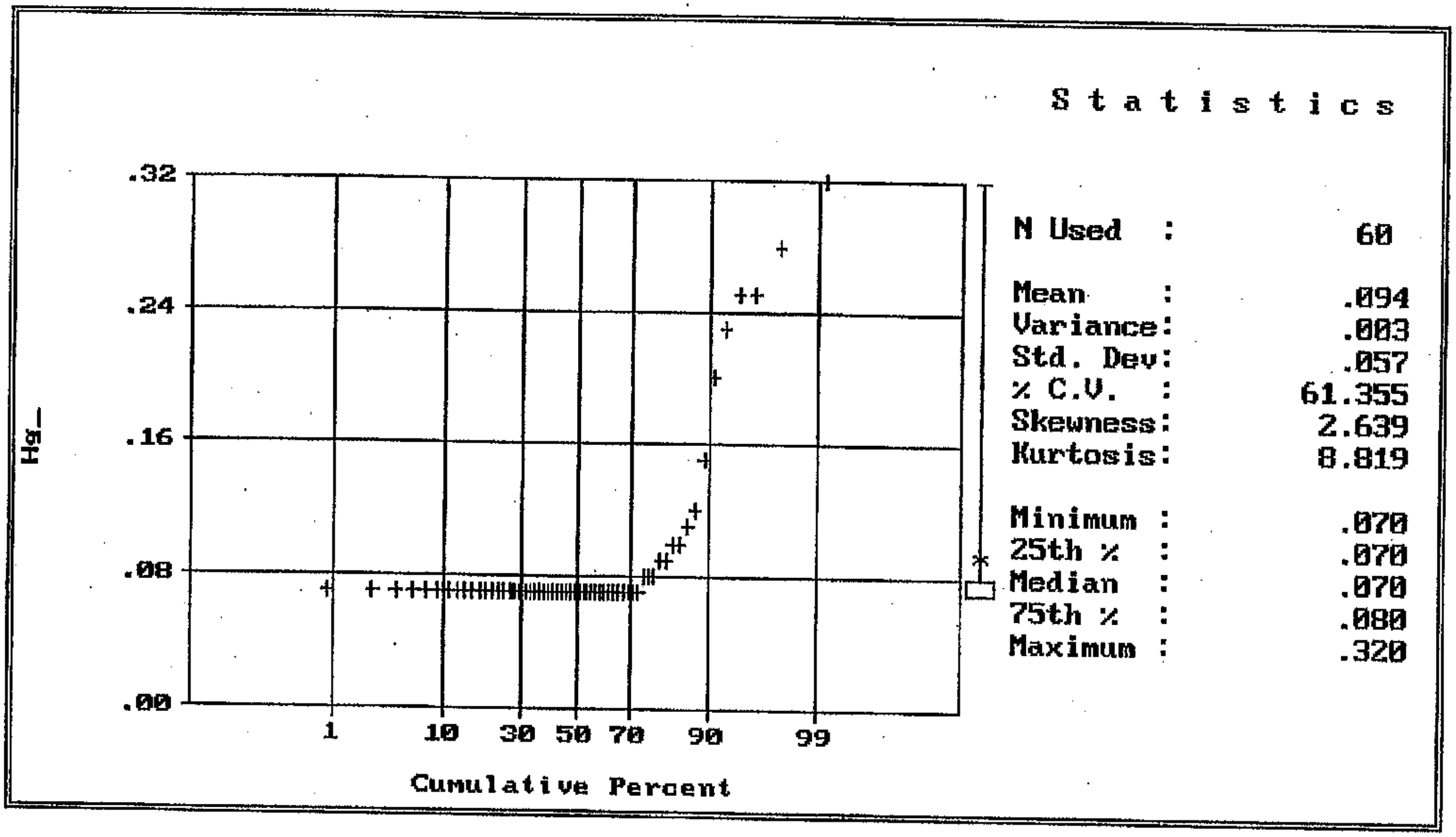
Note: The data set distribution is lognormal.

FIGURE 12
PROBABILITY PLOT OF LEAD CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



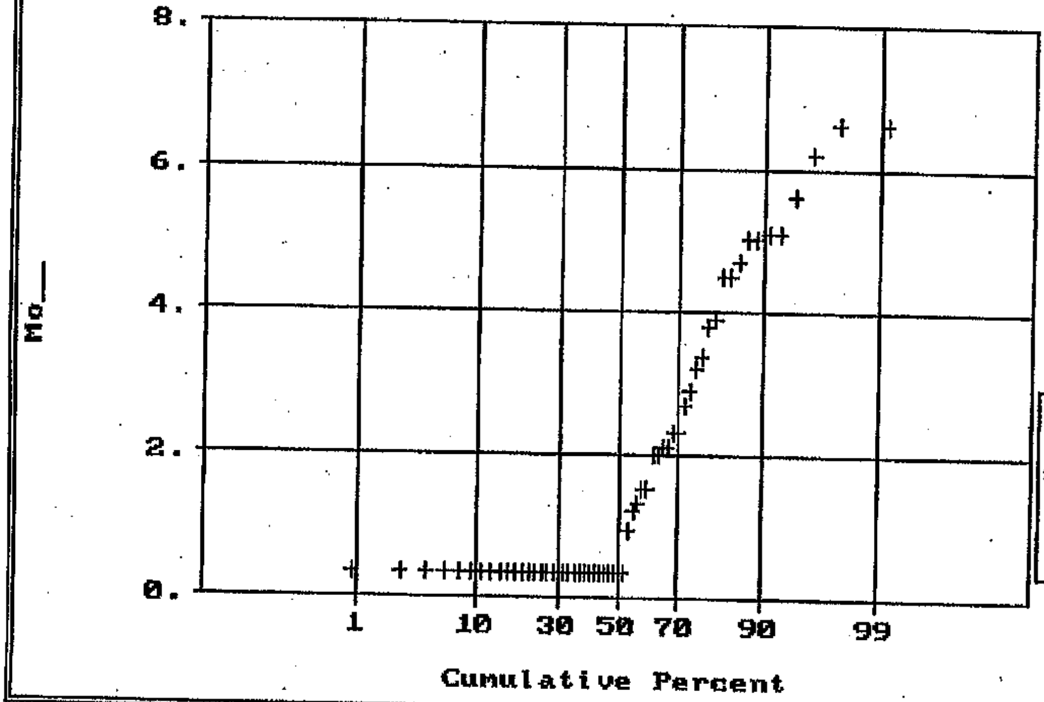
Note: The data set distribution is lognormal.

FIGURE 13
PROBABILITY PLOT OF MANGANESE CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



Note: The data set distribution is nonparametric.

FIGURE 14
PROBABILITY PLOT OF MERCURY CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD

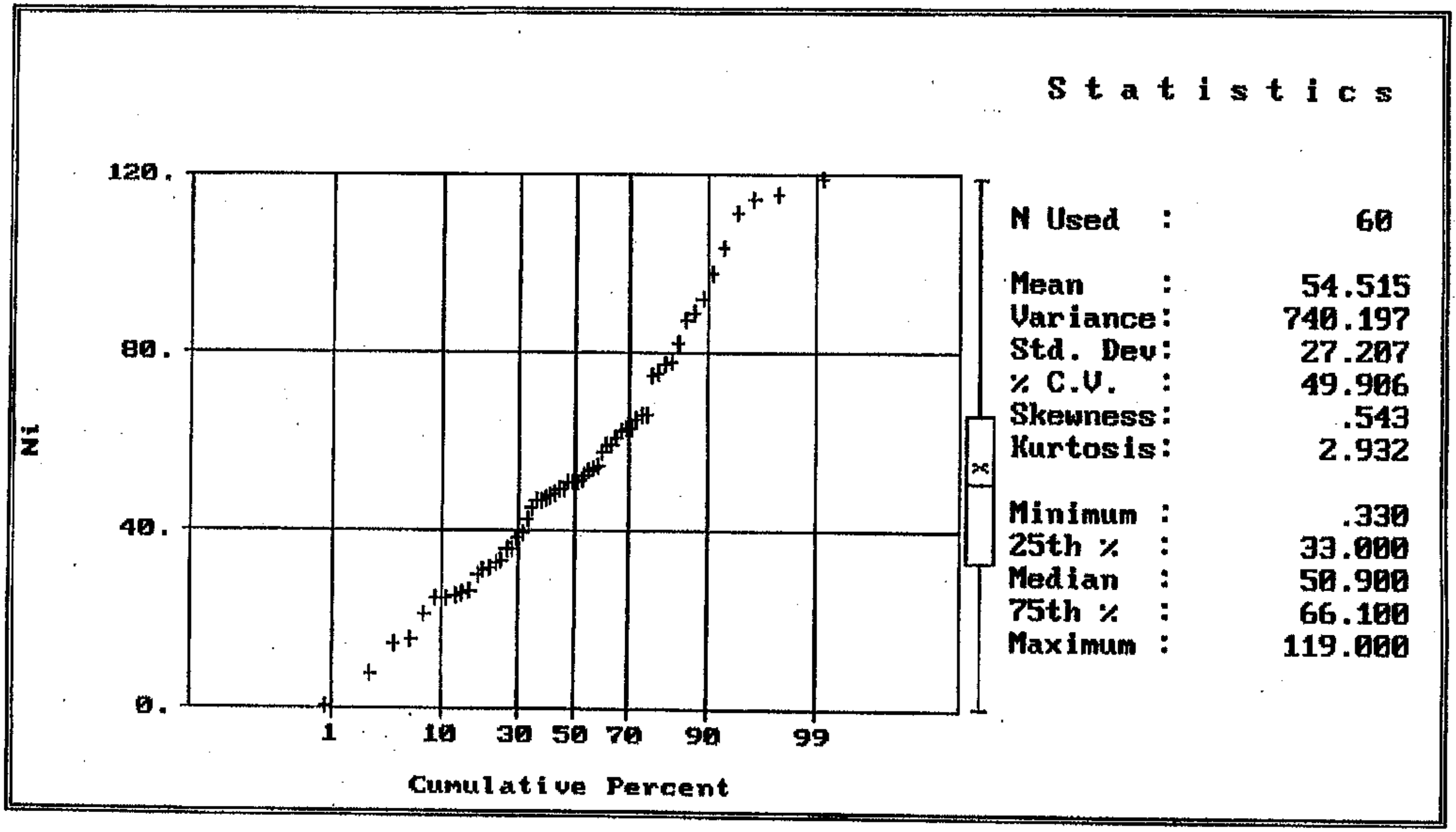


Statistics

N Used :	59
Mean :	1.845
Variance:	3.922
Std. Dev:	1.980
% C.V. :	107.321
Skewness:	1.035
Kurtosis:	2.701
Minimum :	.350
25th % :	.350
Median :	.350
75th % :	2.975
Maximum :	6.600

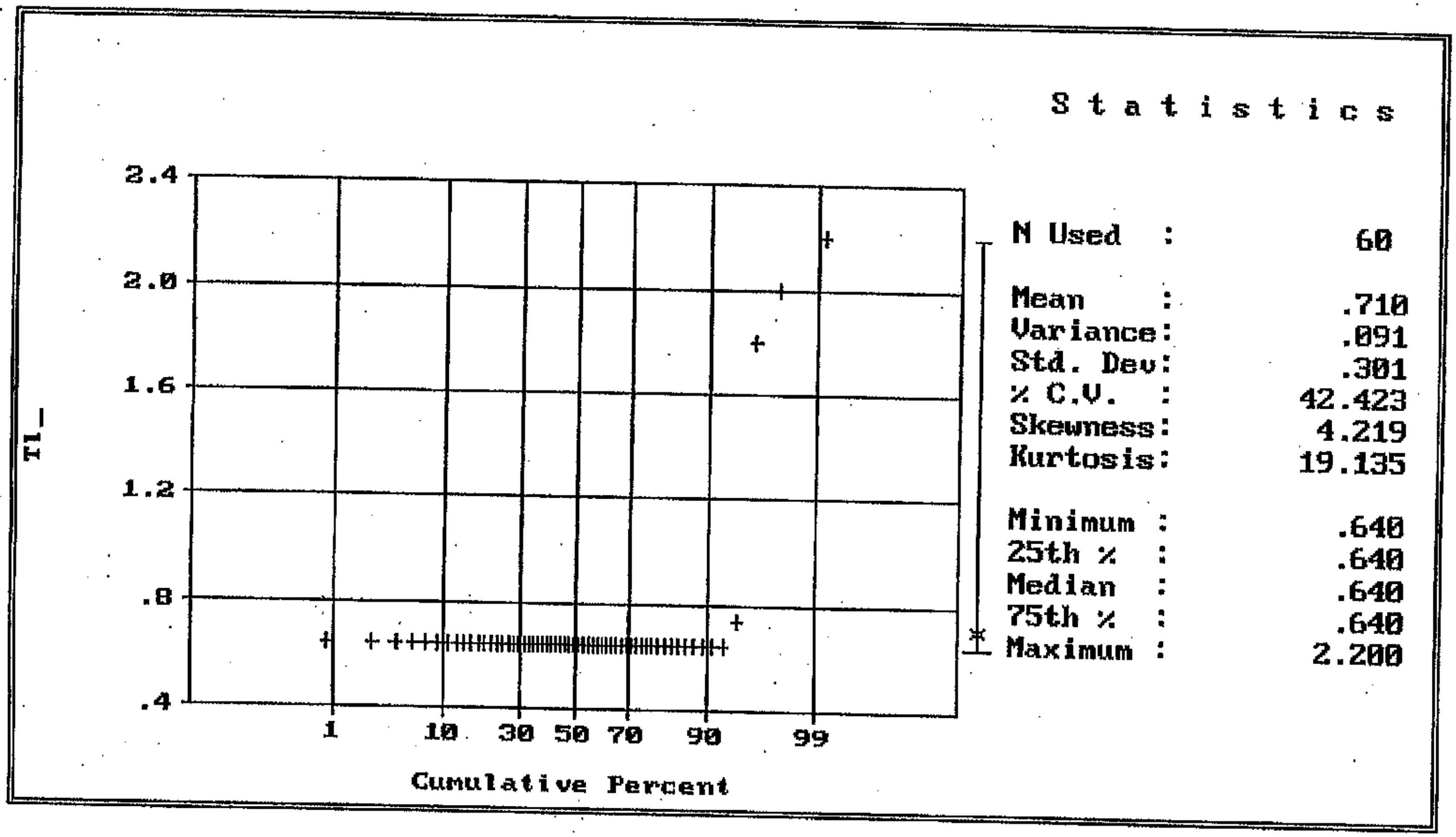
Note: The data set distribution is nonparametric.

FIGURE 15
PROBABILITY PLOT OF MOLYBDENUM CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



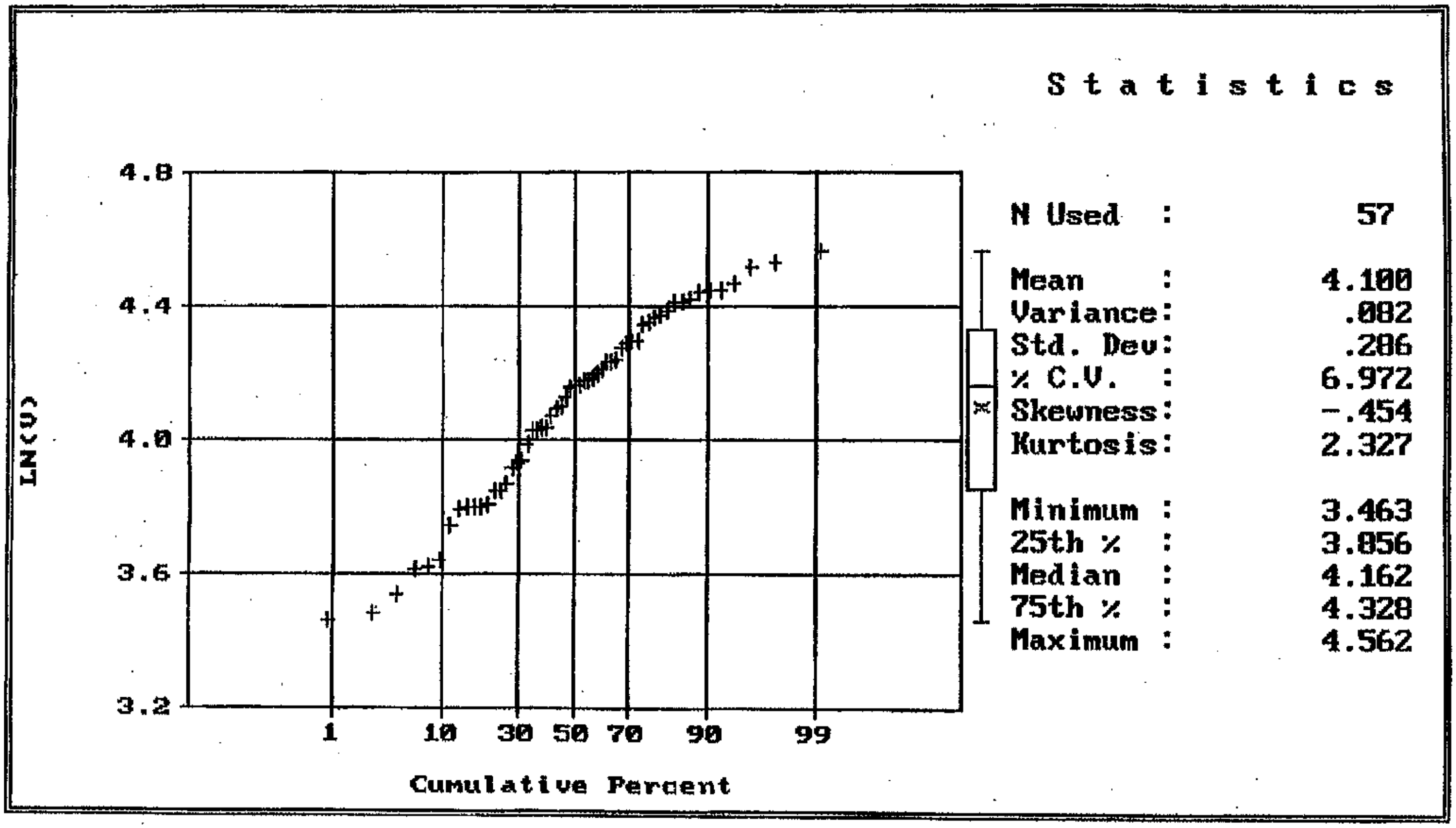
Note: The data set distribution is normal.

FIGURE 16
PROBABILITY PLOT OF NICKEL CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



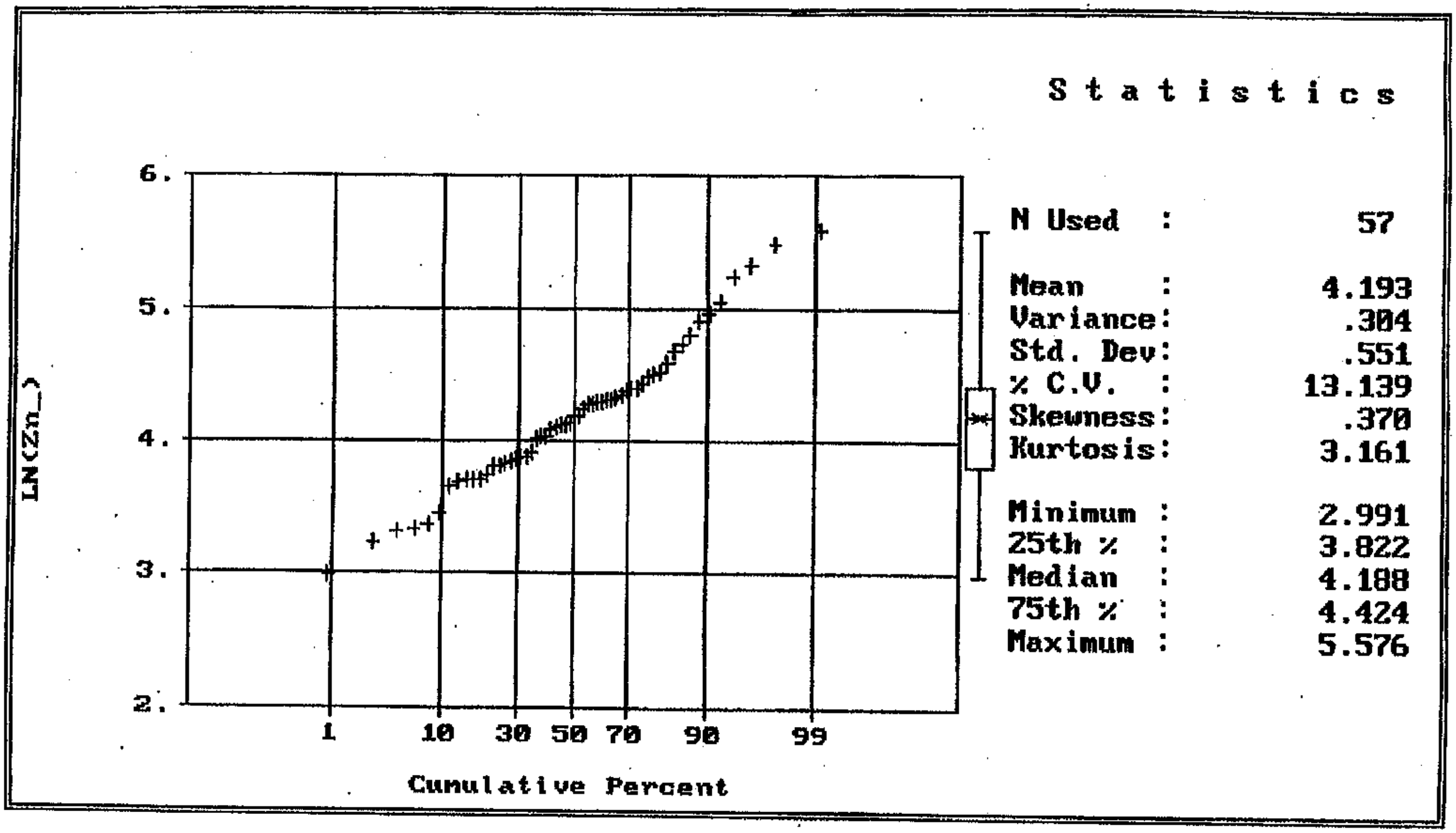
Note: The data set distribution is nonparametric.

FIGURE 17
PROBABILITY PLOT OF THALLIUM CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



Note: The data set distribution is lognormal.

FIGURE 18
PROBABILITY PLOT OF VANADIUM CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD



Note: The data set distribution is lognormal.

FIGURE 19
PROBABILITY PLOT OF ZINC CONCENTRATIONS
IN SOILS OF THE TIDAL AREA SITES
NAVAL WEAPONS STATION CONCORD

TABLES

TABLE E-1
AMBIENT METALS CONCENTRATIONS IN SUBSURFACE SOILS OF THE TIDAL AREA SITES
NWS CONCORD, TIDAL AREA SITES

Metal	Number of Detections/ Samples Analyzed	Values Excluded		Ambient Data Set Size[a]	Ambient Data Set Distribution	Soil Metal Concentration Statistics for Ambient Data Sets (mg/kg)							U.S. EPA PRG[g] (mg/kg)
											Ambient Limit		
		Too Low	Too High			Minimum Detected[b]	Maximum Detected[c]	Mean[d]	Standard Deviation	Coefficient of Variance	**95[th] percentile[e]**	**99[th] percentile[e]**	
Aluminum	61/61	0	0	61	Normal	82.2	27,300.0	15,184.5	6,615.6	0.44	**27,000**	**27,300**	77,000
Antimony	13/50	2	2	46	Nonparam.	0.6	2.2	0.6	N/A	N/A	**1.9**	**2.2**	31
Arsenic	51/61	2	2	57	Nonparam.	2.3	26.6	7.1	N/A	N/A	**26***	**27***	0.38
Barium	61/61	1	1	59	Lognormal	18.5	529.0	111.6	109.8	0.19	**420**	**530**	5,300
Beryllium	6/61	0	0	61	Nonparam.	0.11	0.18	0.11	N/A	N/A	**0.13**	**0.18***	0.14
Cadmium	6/61	0	0	61	Nonparam.	0.09	1.9	0.09	N/A	N/A	**0.55**	**1.9**	9.0[h]/38
Chromium	57/61	2	2	57	Lognormal	11.2	82.1	48.2	29.1	0.15	**81**	**82.1**	210[i]
Cobalt	59/61	2	2	57	Lognormal	1.7	35.6	12.7	8.1	0.26	**24**	**36**	4,600
Copper	56/61	1	0	60	Lognormal	8.8	80.6	33.7	17.2	0.14	73	81	2,800
Lead	58/61	3	3	55	Lognormal	1.9	94.7	16.1	15.5	0.33	70	95	130[h]/400
Manganese	61/61	1	1	59	Lognormal	53.1	1,470.0	352.8	295.7	0.13	**1,200**	**1,500**	3,200
Mercury	20/60	0	0	60	Nonparam.	0.07	0.32	0.07	N/A	N/A	**0.25**	**0.32**	23[j]
Molybdenum	31/61	0	2	59	Nonparam.	0.35	6.6	0.35	N/A	N/A	**6.2**	6.6	380
Nickel	61/61	0	1	60	Normal	0.33	119.0	54.5	27.2	0.50	**110**	**120**	150[h]/1,500

TABLE E-1
AMBIENT METALS CONCENTRATIONS IN SUBSURFACE SOILS OF THE TIDAL AREA SITES
NWS CONCORD, TIDAL AREA SITES

Metal	Number of Detections/ Samples Analyzed	Values Excluded		Ambient Data Set Size[a]	Ambient Data Set Distribution	Soil Metal Concentration Statistics for Ambient Data Sets (mg/kg)							U.S. EPA PRG[g] (mg/kg)
											Ambient Limit		
		Too Low	Too High			Minimum Detected[b]	Maximum Detected[c]	Mean[d]	Standard Deviation	Coefficient of Variance	**95th percentile[e]**	**99th percentile[e]**	
Selenium	2/61	0	0	61	Not tested	2.8	4.8	DL	N/A	N/A	**DL[f]**	**DL[f]**	380
Silver	0/61	0	0	61	Not tested	N/A	N/A	DL	N/A	N/A	**DL[f]**	**DL[f]**	380
Thallium	6/61	0	1	60	Nonparam.	0.64	2.2	0.64	N/A	N/A	**1.8**	2.2	5.4[k]
Vanadium	61/61	2	2	57	Lognormal	31.9	95.8	62.9	18.4	0.07	**91**	96	540
Zinc	56/61	1	3	57	Lognormal	27.5	264.0	77.1	45.9	0.13	**210**	264	23,000

Notes:

a The ambient data set consists of both detected and not detected results after exclusion of anomalously low and high values. For metals with high detection frequencies, substitute values of one-half the sample quantitation limit (SQL) are used for all analytical results reported as not detected. For metals with low detection frequencies, not detected values are equal to the lowest detected values. At the request of the Department of Toxic Substances Control (DTSC), the lowest detected value was also substituted for all arsenic analytical results reported as not detected.

b The minimum detected concentration in ambient data set after exclusion of anomalously low values

c The maximum detected concentration in ambient data set after exclusion of anomalously high values

d The value presented is the arithmetic mean, calculated using distribution-dependent formulae.

e The 95th and 99th percentiles of the distribution were calculated using nonparametric formula.

f The ambient limit was set at the detection limit.

g U.S. Environmental Protection Agency (EPA) Region IX preliminary remediation goals (PRG) for residential use, unless otherwise noted (EPA 1996).

h Cal-Modified PRGs (EPA 1996)

i The PRG for total chromium assumes a one to six ratio of chromium VI/chromium III

TABLE E-1
AMBIENT METALS CONCENTRATIONS IN SUBSURFACE SOILS OF THE TIDAL AREA SITES
NWS CONCORD, TIDAL AREA SITES

j	PRG for mercuric chloride
k	PRG for thallic oxide
mg/kg	Milligrams per kilogram
DL	Detection limit
N/A	Not available
*	The ambient limit exceeds the PRG.

APPENDIX F

ORNL LOAEL AND NOAEL STUDIES USED AS TRVS

Compound: Antimony
Form: Antimony Potassium Tartrate
Reference: Schroeder et al. 1968b
Test Species: Mouse
Body weight: 0.03 kg (EPA 1988a)
Water Consumption: 0.0075 L/d (calculated using allometric equation from EPA 1988a)
Study Duration: lifetime (>1 yr = chronic)
Endpoint: lifespan, longevity
Exposure Route: oral in water
Dosage: one dose level:
5 ppm Sb = LOAEL

Calculations:

$$LOAEL: \left(\frac{5\ mg\ Sb}{L\ water} x \frac{7.5\ mL\ water}{day} x \frac{1\ L}{1000\ mL}\right) / \ 0.03\ kg\ BW = 1.25\ mg/kg/d$$

Comments: Because median lifespan was reduced among female mice exposed to the 5 ppm dose level and the study considered exposure throughout the entire lifespan, this dose was considered to be a chronic LOAEL. A chronic NOAEL was estimated by multiplying the chronic LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1.

Final NOAEL: 0.125 mg/kg/d
Final LOAEL: 1.25 mg/kg/d

Compound: Barium

Form: Barium Chloride

Reference: Perry et al. 1983

Test Species: Rat

Body weight: 0.435 kg (from study)

Water Consumption: 0.022 L/d (from study)

Study Duration: 16 months (> 1yr = chronic)

Endpoint: growth, hypertension

Exposure Route: oral in water

Dosage: three dose level:

1, 10, and 100, ppm Ba (as Barium Chloride);

NOAEL = 100 ppm

Calculations:

$$NOAEL : \left(\frac{100\ mg\ Ba}{L\ water} x \frac{22\ mL\ water}{day} x \frac{1\ L}{1000\ mL} \right) / \ 0.435\ kg\ BW = 5.06\ mg/kg/d$$

Comments: While none of the three dose levels had any affect on food or water consumption or on growth, cardiovascular hypertension was observed among rats exposed to 10 or 100 ppm Ba. Because the significance of hypertension in wild populations is unclear, the maximum dose that did not affect growth, food or water consumption (100 ppm) was considered to be a chronic NOAEL.

Final NOAEL: 5.1 mg/kg/d

Compound: Barium

Form: Barium Chloride (66% Ba)

Reference: Borzelleca et al. 1988

Test Species: Rat

Body weight: 0.35 kg (EPA 1988a)

Study Duration: 10 days (< 1yr = subchronic)

Endpoint: mortality

Exposure Route: oral gavage in water

Dosage: four dose levels:

100, 145, 209, and 300 mg Barium Chloride /kg/d

LOAEL = (300x0.66)=198 mg Ba /kg/d

Calculations: not applicable

Comments: Exposure of rats to 300 mg/kg/d $BaCl_2$ for 10 days resulted in 30% mortality to female rats. No adverse effects were observed at any other dose levels. The 300 mg/kg/d dose was considered to be a subchronic LOAEL. A chronic LOAEL was estimated by multiplying the subchronic LOAEL by a subchronic to chronic uncertainty factor of 0.1.

Final LOAEL: 19.8 mg/kg/d

Compound:	Barium
Form:	Barium Hydroxide
Reference:	Johnson et al. 1960
Test Species:	1-day old chicks Body weight: 0.121 kg (mean + at 14 d; EPA 1988a) Food Consumption: 0.0126 kg/d (calculated using allometric equation from EPA 1988a)
Study Duration:	4 wk (< 10 wk = subchronic)
Endpoint:	mortality
Exposure Route:	oral in diet
Dosage:	eight dose level: 250, 500, 1000, 2000, 4000, 8000, 16,000, and 32,000 ppm Ba (as Barium Hydroxide) NOAEL = 2000 ppm

Calculations:

$$NOAEL: \left(\frac{2000\ mg\ Ba}{kg\ food} x \frac{12.6\ g\ food}{day} x \frac{1\ kg}{1000\ g} \right) / \ 0.121\ kg\ BW = 208.26\ mg/kg/d$$

$$LOAEL: \left(\frac{4000\ mg\ Ba}{kg\ food} x \frac{12.6\ g\ food}{day} x \frac{1\ kg}{1000\ g} \right) / \ 0.121\ kg\ BW = 416.53\ mg/kg/d$$

Comments: To estimate daily Ba intake throughout the 4 week study period, food consumption of 2-week-old chicks was calculated. While this value will over- and underestimate food consumption by younger and older chicks, it was assumed to approximate food consumption throughout the entire 4 week study. While Barium exposures up to 2000 ppm produced no mortality, chicks in the 4000 to 32000 ppm groups experienced 5% to 100% mortality. Because 2000 ppm was the highest nonlethal dose, this dose was considered to be a subchronic NOAEL. The 4000 ppm dose was considered to be a subchronic LOAEL. Chronic NOAELs and LOAELs were estimated by multiplying the subchronic NOAELs and LOAELs by a subchronic tochronic uncertainty factor of 0.1.

Final NOAEL: 20.8 mg/kg/d
Final LOAEL: 41.7 mg/kg/d

Compound: Chromium

Form: Cr^{+6}

Reference: Steven et al. 1976 (cited in Eisler 1986)

Test Species: Rat

Body weight: 0.35 kg (EPA 1988a)

Water Consumption: 0.046 L/d (calculated using allometric equation from EPA 1988a)

Study Duration: 3 months (<1 yr = subchronic)

Endpoint: mortality

Exposure Route: oral in water

Dosage: two dose levels:

134 and 1000 ppm Cr^{+6} in water; 1000 ppm = LOAEL

Calculations:

$$LOAEL: \left(\frac{1000\ mg\ Cr^{+6}}{L\ water} x \frac{0.046\ L\ water}{day} \right) / \ 0.35\ kg\ BW = 131.4\ mg/kg/d$$

Comments: Because the 1000 ppm dose was identified as the toxicity threshold, this dose was considered to be a subchronic LOAEL. A chronic LOAEL was estimated by multiplying the subchronic LOAEL by a subchronic-chronic uncertainty factor of 0.1.

Final LOAEL: 13.14 mg/kg/d

Compound: Chromium

Form: Cr^{+3} as $CrK(SO_4)_2$

Reference: Haseltine et al. , unpubl. data

Test Species: Black duck

Body weight: 1.25 kg (mean $\underline{+}$; Dunning 1984)

Food Consumption: Congeneric Mallard ducks, weighing 1 kg consume 100 g food/d (Heinz et al.1989). Therefore, it was assumed that a 1.25 kg black duck would consume 125 g food/d.

Study Duration: 10 mo. (>10 weeks and during a critical lifestage = chronic)

Endpoint: reproduction

Exposure Route: oral in diet

Dosage: two dose levels:

10 and 50 ppm Cr^{+3} in diet; NOAEL = 10 ppm

Calculations:

$$NOAEL: \left(\frac{10\ mg\ Cr^{+3}}{kg\ food} x \frac{125\ g\ food}{day} x \frac{1\ kg}{1000\ g} \right) / 1.25\ kg\ BW = 1\ mg/kg/d$$

$$LOAEL: \left(\frac{50\ mg\ Cr^{+3}}{kg\ food} x \frac{125\ g\ food}{day} x \frac{1\ kg}{1000\ g} \right) / 1.25\ kg\ BW = 5\ mg/kg/d$$

Comments: While duckling survival was reduced at the 50 ppm dose level, no significant differences were observed at the 10 ppm Cr^{+3} dose level. Because the study considered exposure throughout a critical lifestage (reproduction), the dose 50 ppm dose was considered to be a chronic LOAEL and the dose 10 ppm dose was considered to be a chronic NOAEL.

Final NOAEL: 1 mg/kg/d

Final LOAEL: 5 mg/kg/d

Compound: Molybdenum

Form: Molybdate (MoO_4)

Reference: Schroeder and Mitchner 1971

Test Species: Mouse

Body weight: 0.03 kg (EPA 1988a)

Food Consumption: 0.0055 kg/d

Water Consumption: 0.0075 L/d

(calculated using allometric equation from EPA 1988a)

Study Duration: 3 generations (> 1 yr and during critical lifestage=chronic)

Endpoint: reproduction

Exposure Route: oral in water

Dosage: one dose level:

10 mg Mo/L + 0.45 mg/kg in diet = LOAEL

Calculations:

$$LOAEL: \left(\frac{0.45\,mg\,Mo}{kg\,food} x \frac{5.5g\,food}{day} x \frac{1\,kg}{1000\,g}\right) / 0.03\,kg\,BW = 0.0825 mg/kg/d$$

$$NOAEL: \left(\frac{10\,mg\,Mo}{L\,water} x \frac{7.5mL\,water}{day} x \frac{1\,L}{1000\,mL}\right) / \,0.03\,kg\,BW = 2.5 mg/kg/d$$

Total Exposure = 2.5 mg/kg/d + 0.0825 mg/kg/d =2.5825 mg/kg/d

Comments: Because mice exposed to Mo displayed reduced reproductive success with a high incidence of runts, this dose was considered to be a chronic LOAEL. A chronic NOAEL was estimated by multiplying the chronic LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1.

Final NOAEL: 0.26 mg/kg/d

Final LOAEL: 2.6 mg/kg/d

Compound: Molybdenum

Form: Sodium Molybdate

Reference: Lepore and Miller 1965

Test Species: Chicken
Body weight: 1.5 kg (EPA 1988a)
Food Consumption: 0.106 kg/d
(calculated using allometric equation from EPA 1988a)

Study Duration: 21 d through reproduction (during a critical lifestage=chronic)

Endpoint: reproduction

Exposure Route: oral in diet

Dosage: three dose levels:
500, 1000, and 2000 ppm Mo; 500 ppm = LOAEL

Calculations:

$$LOAEL: \left(\frac{500\ mg\ Mo}{L\ water} \times \frac{106mg\ food}{day} \times \frac{1\ kg}{1000\ mg} \right) / \ 1.5\ kg\ BW = 35.33\ mg/kg/d$$

Comments: Embryonic viability was reduced to zero in the 500 ppm Mo treatment, therefore this dose was considered to be a chronic LOAEL. A chronic NOAEL was estimated by multiplying the chronic LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1.

Final NOAEL: 3.5/kg/d
Final LOAEL: 35.3 mg/kg/d

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APPENDIX G

DOSE CALCULATIONS FOR THE MALLARD DUCK

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APPENDIX G1

MALLARD DOSE CALCULATIONS TBB DISPOSAL SITE NWS SBD CONCORD

Chemical[a]	Sample Location	Dose Type	IR_{prey} (kg/day)	[amphipod] (mg/kg dry wt.)	$IR_{amphipod}$ (kg/day) (100% IR_{prey})	Ingestion from Aquatic Prey (mg/day)	[sediment 95%UCL] (mg/kg dry wt.)	$IR_{sediment}$ (kg/day) 3.3%	Ingestion from Sediment	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Antimony	95 UCL	Typical	0.0917	7.8	0.0917	0.72	10.10	0.003	0.03	0.01	1.16	6.43E-03					
Arsenic	95 UCL	Typical	0.0917	141	0.0917	12.9	28.70	0.003	0.09	0.01	1.16	1.12E-01	5.49E+00	2.20E+01	X		
Beryllium	95 UCL	Typical	0.0917	1.38	0.0917	0.13	0.24	0.003	0.00	0.01	1.16	1.09E-03					
Cadmium	95 UCL	Typical	0.0917	5.1	0.0917	0.47	1.70	0.003	0.01	0.01	1.16	4.07E-03	8.62E-02	1.76E+01	X		
Chromium	95 UCL	Typical	0.0917	63.3	0.0917	5.8	204.00	0.003	0.62	0.01	1.16	5.53E-02					
Copper	95 UCL	Typical	0.0917	1147	0.0917	105	1094.00	0.003	3.31	0.01	1.16	9.35E-01	2.59E+00	6.44E+01	X		
Lead	95 UCL	Typical	0.0917	385	0.0917	35.3	1126.00	0.003	3.41	0.01	1.16	3.34E-01	2.37E-02	9.43E+00		X	
Mercury	95 UCL	Typical	0.0917	2.4	0.0917	0.22	1.70	0.003	0.01	0.01	1.16	1.91E-03	4.02E-02	1.85E-01	X		
Molybdenum	95 UCL	Typical	0.0917	14.1	0.0917	1.3	19.40	0.003	0.06	0.01	1.16	1.16E-02					
Selenium	95 UCL	Typical	0.0917	21.5	0.0917	2.0	3.20	0.003	0.01	0.01	1.16	1.70E-02	2.32E-01	9.39E-01	X		
Silver	95 UCL	Typical	0.0917	19.6	0.0917	1.8	1.30	0.003	0.00	0.01	1.16	1.56E-02					
Zinc	95 UCL	Typical	0.0917	2855	0.0917	262	1309.00	0.003	3.96	0.01	1.16	2.29E+00	1.79E+01	1.79E+02	X		

Notes:

[amphipod] Concentration of chemical in amphipod
BW Body weight
IR_{prey} Ingestion rate of prey
$IR_{sediment}$ Ingestion rate of sediment
kg/day Kilograms per day
mg/kg Milligrams per kilogram
mg/kg/day Milligrams per kilogram per day
NA Not available
[sediment] Concentration of chemical in sediment
SUF Site use factor
TRV Toxicity reference value
UCL Upper confidence limit

a Chemicals were selected based on available TRV information
b The dose for the 95 percent upper cofidence limit was only calculated for chemicals with an HQ greater than 1
--- Not applicable to the analysis

APPENDIX G2

MALLARD HAZARD QUOTIENT CALCULATIONS
TBB DISPOSAL SITE NWS SBD CONCORD

Chemical	Sample Location	Typical Dose (mg/kg/day)	Low TRV (mg/kg/day)	High TRV (mg/kg/day)	HQ_1 (Typical Dose/ High TRV)	HQ_2 (Typical Dose/ Low TRV)
Antimony	95 UCL[a]	6.43E-03			--	--
Arsenic	95 UCL[a]	1.12E-01	5.49E+00	2.20E+01	5.10E-03	2.04E-02
Beryllium	95 UCL[a]	1.09E-03			--	--
Cadmium	95 UCL[a]	4.07E-03	8.62E-02	1.76E+01	2.31E-04	4.72E-02
Chromium	95 UCL[a]	5.53E-02			--	
Copper	95 UCL[a]	9.35E-01	2.59E+00	6.44E+01	1.45E-02	3.61E-01
Lead	95 UCL[a]	3.34E-01	2.37E-02	9.43E+00	3.54E-02	**1.41E+01**
Mercury	95 UCL[a]	1.91E-03	4.02E-02	1.85E-01	1.03E-02	4.75E-02
Molybdenum	95 UCL[a]	1.16E-02				--
Selenium	95 UCL[a]	1.70E-02	2.32E-01	9.39E-01	1.81E-02	7.34E-02
Silver	95 UCL[a]	1.56E-02			--	--
Zinc	95 UCL[a]	2.29E+00	1.79E+01	1.79E+02	1.28E-02	1.28E-01

Notes: **Bold font indicates an HQ greater than 1**

HQ Hazard quotient
mg/kg/day Milligrams per kilogram per day
TRV Toxicity reference value
UCL Upper confidence limit of the mean

a The dose for the mallard was calculated using the 95 UCL of aquatic and wetland sediment data (n=48) and the maximum tissue concentration

APPENDIX H

DOSE CALCULATIONS FOR THE BLACK-NECKED STILT

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APPENDIX H1

BLACK-NECKED STILT DOSE CALCULATIONS IN THE FROID AND TAYLOR AQUATIC UNIT TIDAL AREA QEA, NWS SBD CONCORD

Chemical[a]	Sample Location	Dose Type	IR_{prey} (kg/day)	[amphipod] (mg/kg)	$IR_{amphipod}$ (kg/day) (100% IR_{prey})	Ingestion from Aquatic Prey (mg/day)	[sediment] (mg/kg)	$IR_{sediment}$ (kg/day) 7.3%	Ingestion from Sediment	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Antimony	95 UCL	Typical	0.026	7.81	0.026	0.20	10.10	1.876E-03	0.02	0.50	0.166	0.66					
Arsenic	95 UCL	Typical	0.026	140.92	0.026	3.62	28.70	1.876E-03	0.05	0.50	0.166	11.07	3.72	14.89		X	
Beryllium	95 UCL	Typical	0.026	1.38	0.026	0.04	0.24	1.876E-03	0.00	0.50	0.166	0.11					
Cadmium	95 UCL	Typical	0.026	5.09	0.026	0.13	1.70	1.876E-03	0.00	0.50	0.166	0.40	0.06	11.95		X	
Chromium	95 UCL	Typical	0.026	63.33	0.026	1.63	204.00	1.876E-03	0.38	0.50	0.166	6.05					
Copper	95 UCL	Typical	0.026	1147.35	0.026	29.49	1094.00	1.876E-03	2.05	0.50	0.166	95.00	1.76	43.64			X
Lead	95 UCL	Typical	0.026	385.40	0.026	9.90	1126.00	1.876E-03	2.11	0.50	0.166	36.20	0.02	6.39			X
Mercury	95 UCL	Typical	0.026	2.36	0.026	0.06	1.70	1.876E-03	0.00	0.50	0.166	0.19	0.027	0.13			X
Molybdenum	95 UCL	Typical	0.026	14.09	0.026	0.36	19.40	1.876E-03	0.04	0.50	0.166	1.20					
Selenium	95 UCL	Typical	0.026	21.45	0.026	0.55	3.20	1.876E-03	0.01	0.50	0.166	1.68	0.16	0.64			X
Silver	95 UCL	Typical	0.026	19.65	0.026	0.50	1.30	1.876E-03	0.00	0.50	0.166	1.53					
Zinc	95 UCL	Typical	0.026	2854.55	0.026	73.36	1309.00	1.876E-03	2.46	0.50	0.166	228.37	12.12	121.21			X

Notes:

[amphipod] Concentration of chemical in amphipod
BW Body weight
IR_{prey} Ingestion rate of prey
$IR_{sediment}$ Ingestion rate of sediment
kg/day Kilograms per day
mg/kg Milligrams per kilogram
mg/kg/day Milligrams per kilogram per day
NA Not available
[sediment] Concentration of chemical in sediment
SUF Site use factor
TRV Toxicity reference value
UCL Upper confidence limit

a Chemicals were selected based on available TRV information
--- Not applicable to the analysis

APPENDIX H2

BLACK-NECKED STILT HAZARD QUOTIENT CALCULATIONS IN THE TBB DISPOSAL SITE, NWS SBD CONCORD

Chemical	Sample Location	Typical Dose (mg/kg/day)	Low TRV (mg/kg/day)	High TRV (mg/kg/day)	HQ_1 (Typical Dose/ High TRV)	HQ_2 (Typical Dose/ Low TRV)
Antimony	95 UCL[a]	0.66			--	--
Arsenic	95 UCL[a]	11.07	3.72	14.89	0.74	**2.98**
Beryllium	95 UCL[a]	0.11			--	--
Cadmium	95 UCL[a]	0.40	0.06	11.95	0.03	**6.91**
Chromium	95 UCL[a]	6.05				
Copper	95 UCL[a]	95.00	1.76	43.64	**2.18**	**54.08**
Lead	95 UCL[a]	36.20	0.0160	6.39	**5.67**	**2256**
Mercury	95 UCL[a]	0.19	0.03	0.13	1.53	**7.05**
Molybdenum	95 UCL[a]	1.20				
Selenium	95 UCL[a]	1.68	0.16	0.64	**2.64**	**10.67**
Silver	95 UCL[a]	1.53			--	--
Zinc	95 UCL[a]	228.37	12.12	121.21	**1.88**	**18.84**

Notes: **Bold font indicates an HQ greater than 1**

na Not available

HQ Hazard quotient

mg/kg/day Milligrams per kilogram per day

TRV Toxicity reference value

UCL Upper confidence limit

a The dose was only calculated for COPECs. 95 percent UCLs include both aquatic and wetland data. The maximum amphipod tissue concentration was used in dose calculat

APPENDIX I

DOSE CALCULATIONS FOR THE SALT MARSH HARVEST MOUSE

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SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	High Dose (mg/kg/day)	Low Dose (mg/kg/day)	High Dose Low TRV (mg/kg/day)[a]	High Dose High TRV (mg/kg/day)[b]	Low Dose Low TRV (mg/kg/day)c	Low Dose High TRV (mg/kg/day)d	HQ_1 (Low Dose/ High TRV)	HQ_2 (High Dose/ Low TRV)	HQ_3 (High Dose/ High TRV)
Antimony	309CSPWSS	0.27	0.11	0.13	1.34	0.13	1.30	8.79E-02	2.03E+00	2.03E-01
Arsenic	309CSPWSS	12.79	5.35	0.40	5.46	0.38	5.28	1.01E+00	3.22E+01	2.34E+00
Barium	309CSPWSS	21.44	8.96	6.44	24.66	6.22	23.83	3.76E-01	3.33E+00	8.69E-01
Beryllium	309CSPWSS	1.95E-02	8.14E-03	0.00	0.00	0.00	0.00			
Cadmium	309CSPWSS	1.33	0.56	0.06	2.85	0.06	2.75	2.03E-01	2.06E+01	4.69E-01
Chromium	309CSPWSS	3.45	1.44	4.09	16.37	3.95	15.81	9.12E-02	8.45E-01	2.11E-01
Copper	309CSPWSS	20.42	8.53	2.87	671.02	2.77	648.25	1.32E-02	7.12E+00	3.04E-02
Lead	309CSPWSS	22.94	9.58	0.00	251.44	0.00	242.91	3.95E-02	1.27E+04	9.12E-02
Mercury	309CSPWSS	0.04	0.02	0.30	5.04	0.29	4.87	3.15E-03	1.22E-01	7.28E-03
Molybdenum	309CSPWSS	3.10	1.29	0.28	2.79	0.27	2.70	4.79E-01	1.11E+01	1.11E+00
Selenium	309CSPWSS	1.75	0.73	0.05	1.29	0.05	1.24	5.87E-01	3.29E+01	1.36E+00
Silver	309CSPWSS	0.14	0.06	0.00	0.00	0.00	0.00			
Zinc	309CSPWSS	213.18	89.08	10.23	491.61	9.88	474.93	1.88E-01	2.08E+01	4.34E-01
Antimony	309SB05	0.07	0.03	0.13	1.34	0.13	1.30	2.13E-02	4.92E-01	4.92E-02
Arsenic	309SB05	0.26	0.11	0.40	5.46	0.38	5.28	2.09E-02	6.65E-01	4.84E-02
Barium	309SB05	7.74	3.23	6.44	24.66	6.22	23.83	1.36E-01	1.20E+00	3.14E-01
Beryllium	309SB05	1.01E-02	4.20E-03	0.00	0.00	0.00	0.00			
Cadmium	309SB05	0.05	0.02	0.06	2.85	0.06	2.75	7.28E-03	7.39E-01	1.68E-02
Chromium	309SB05	1.36	0.57	4.09	16.37	3.95	15.81	3.60E-02	3.33E-01	8.32E-02
Copper	309SB05	5.53	2.31	2.87	671.02	2.77	648.25	3.56E-03	1.93E+00	8.24E-03
Lead	309SB05	2.57	1.07	0.00	251.44	0.00	242.91	4.42E-03	1.42E+03	1.02E-02
Mercury	309SB05	0.01	0.01	0.30	5.04	0.29	4.87	1.16E-03	4.52E-02	2.69E-03
Molybdenum	309SB05	0.84	0.35	0.28	2.79	0.27	2.70	1.30E-01	3.01E+00	3.01E-01
Selenium	309SB05	0.03	0.01	0.05	1.29	0.05	1.24	9.85E-03	5.51E-01	2.28E-02
Silver	309SB05	0.04	0.02	0.00	0.00	0.00	0.00			
Zinc	309SB05	18.47	7.72	10.23	491.61	9.88	474.93	1.63E-02	1.81E+00	3.76E-02
Antimony	309SB106	0.08	0.03	0.13	1.34	0.13	1.30	2.57E-02	5.93E-01	5.93E-02
Arsenic	309SB106	13.80	5.77	0.40	5.46	0.38	5.28	1.09E+00	3.47E+01	2.53E+00
Barium	309SB106	14.60	6.10	6.44	24.66	6.22	23.83	2.56E-01	2.27E+00	5.92E-01
Beryllium	309SB106	1.64E-02	6.87E-03	0.00	0.00	0.00	0.00			
Cadmium	309SB106	0.21	0.09	0.06	2.85	0.06	2.75	3.13E-02	3.18E+00	7.25E-02
Chromium	309SB106	2.56	1.07	4.09	16.37	3.95	15.81	6.77E-02	6.27E-01	1.57E-01
Copper	309SB106	9.10	3.80	2.87	671.02	2.77	648.25	5.86E-03	3.17E+00	1.36E-02
Lead	309SB106	3.24	1.35	0.00	251.44	0.00	242.91	5.57E-03	1.79E+03	1.29E-02
Mercury	309SB106	0.03	0.01	0.30	5.04	0.29	4.87	2.18E-03	8.49E-02	5.05E-03
Molybdenum	309SB106	1.55	0.65	0.28	2.79	0.27	2.70	2.40E-01	5.56E+00	5.56E-01
Selenium	309SB106	0.13	0.05	0.05	1.29	0.05	1.24	4.22E-02	2.36E+00	9.76E-02
Silver	309SB106	0.05	0.02	0.00	0.00	0.00	0.00			
Zinc	309SB106	38.79	16.21	10.23	491.61	9.88	474.93	3.41E-02	3.79E+00	7.89E-02
Antimony	SB01	1.21	0.50	0.13	1.34	0.13	1.30	3.88E-01	8.98E+00	8.98E-01
Arsenic	SB01	104.56	43.69	0.40	5.46	0.38	5.28	8.28E+00	2.63E+02	1.91E+01
Barium	SB01	387.82	162.05	6.44	24.66	6.22	23.83	6.80E+00	6.03E+01	1.57E+01
Beryllium	SB01	5.46E-02	2.28E-02	0.00	0.00	0.00	0.00			
Cadmium	SB01	0.19	0.08	0.06	2.85	0.06	2.75	2.84E-02	2.88E+00	6.56E-02
Chromium	SB01	11.85	4.95	4.09	16.37	3.95	15.81	3.13E-01	2.90E+00	7.24E-01
Copper	SB01	253.94	106.11	2.87	671.02	2.77	648.25	1.64E-01	8.85E+01	3.78E-01
Lead	SB01	43.80	18.30	0.00	251.44	0.00	242.91	7.54E-02	2.42E+04	1.74E-01
Mercury	SB01	2.14	0.89	0.30	5.04	0.29	4.87	1.83E-01	7.13E+00	4.24E-01
Molybdenum	SB01	48.60	20.31	0.28	2.79	0.27	2.70	7.52E+00	1.74E+02	1.74E+01
Selenium	SB01	0.61	0.26	0.05	1.29	0.05	1.24	2.06E-01	1.15E+01	4.76E-01

APPENDIX I1

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	High Dose (mg/kg/day)	Low Dose (mg/kg/day)	High Dose Low TRV (mg/kg/day)[a]	High Dose High TRV (mg/kg/day)[b]	Low Dose Low TRV (mg/kg/day)c	Low Dose High TRV (mg/kg/day)d	HQ_1 (Low Dose/ High TRV)	HQ_2 (High Dose/ Low TRV)	HQ_3 (High Dose/ High TRV)
Silver	SB01	2.26	0.94	0.00	0.00	0.00	0.00			
Zinc	SB01	2233.14	933.13	10.23	491.61	9.88	474.93	1.96E+00	2.18E+02	4.54E+00
Antimony	SB02	0.17	0.07	0.13	1.34	0.13	1.30	5.55E-02	1.28E+00	1.28E-01
Arsenic	SB02	10.38	4.34	0.40	5.46	0.38	5.28	8.22E-01	2.61E+01	1.90E+00
Barium	SB02	18.56	7.75	6.44	24.66	6.22	23.83	3.25E-01	2.88E+00	7.52E-01
Beryllium	SB02	2.82E-02	1.18E-02	0.00	0.00	0.00	0.00			
Cadmium	SB02	0.02	0.01	0.06	2.85	0.06	2.75	2.53E-03	2.57E-01	5.86E-03
Chromium	SB02	1.85	0.77	4.09	16.37	3.95	15.81	4.88E-02	4.52E-01	1.13E-01
Copper	SB02	10.73	4.49	2.87	671.02	2.77	648.25	6.92E-03	3.74E+00	1.60E-02
Lead	SB02	0.59	0.25	0.00	251.44	0.00	242.91	1.02E-03	3.28E+02	2.36E-03
Mercury	SB02	0.15	0.06	0.30	5.04	0.29	4.87	1.31E-02	5.09E-01	3.03E-02
Molybdenum	SB02	0.38	0.16	0.28	2.79	0.27	2.70	5.82E-02	1.34E+00	1.34E-01
Selenium	SB02	0.43	0.18	0.05	1.29	0.05	1.24	1.45E-01	8.09E+00	3.34E-01
Silver	SB02	0.03	0.01	0.00	0.00	0.00	0.00			
Zinc	SB02	48.87	20.42	10.23	491.61	9.88	474.93	4.30E-02	4.78E+00	9.94E-02
Antimony	SB03	18.14	7.58	0.13	1.34	0.13	1.30	5.84E+00	1.35E+02	1.35E+01
Arsenic	SB03	254.24	106.24	0.40	5.46	0.38	5.28	2.01E+01	6.40E+02	4.66E+01
Barium	SB03	63.67	26.60	6.44	24.66	6.22	23.83	1.12E+00	9.89E+00	2.58E+00
Beryllium	SB03	3.00E-02	1.25E-02	0.00	0.00	0.00	0.00			
Cadmium	SB03	3.67	1.53	0.06	2.85	0.06	2.75	5.57E-01	5.66E+01	1.29E+00
Chromium	SB03	10.89	4.55	4.09	16.37	3.95	15.81	2.88E-01	2.67E+00	6.65E-01
Copper	SB03	2785.84	1164.08	2.87	671.02	2.77	648.25	1.80E+00	9.71E+02	4.15E+00
Lead	SB03	131.41	54.91	0.00	251.44	0.00	242.91	2.26E-01	7.26E+04	5.23E-01
Mercury	SB03	134.43	56.17	0.30	5.04	0.29	4.87	1.15E+01	4.48E+02	2.67E+01
Molybdenum	SB03	90.69	37.90	0.28	2.79	0.27	2.70	1.40E+01	3.24E+02	3.24E+01
Selenium	SB03	0.44	0.18	0.05	1.29	0.05	1.24	1.47E-01	8.22E+00	3.40E-01
Silver	SB03	0.96	0.40	0.00	0.00	0.00	0.00			
Zinc	SB03	2162.16	903.47	10.23	491.61	9.88	474.93	1.90E+00	2.11E+02	4.40E+00
Antimony	SB04	3.90	1.63	0.13	1.34	0.13	1.30	1.26E+00	2.90E+01	2.90E+00
Arsenic	SB04	109.58	45.79	0.40	5.46	0.38	5.28	8.68E+00	2.76E+02	2.01E+01
Barium	SB04	77.15	32.24	6.44	24.66	6.22	23.83	1.35E+00	1.20E+01	3.13E+00
Beryllium	SB04	5.01E-02	2.09E-02	0.00	0.00	0.00	0.00			
Cadmium	SB04	1.87	0.78	0.06	2.85	0.06	2.75	2.84E-01	2.88E+01	6.56E-01
Chromium	SB04	10.37	4.33	4.09	16.37	3.95	15.81	2.74E-01	2.54E+00	6.33E-01
Copper	SB04	157.88	65.97	2.87	671.02	2.77	648.25	1.02E-01	5.50E+01	2.35E-01
Lead	SB04	86.07	35.96	0.00	251.44	0.00	242.91	1.48E-01	4.75E+04	3.42E-01
Mercury	SB04	10.69	4.47	0.30	5.04	0.29	4.87	9.17E-01	3.56E+01	2.12E+00
Molybdenum	SB04	30.06	12.56	0.28	2.79	0.27	2.70	4.65E+00	1.08E+02	1.08E+01
Selenium	SB04	13.10	5.48	0.05	1.29	0.05	1.24	4.41E+00	2.47E+02	1.02E+01
Silver	SB04	0.40	0.17	0.00	0.00	0.00	0.00			
Zinc	SB04	1146.60	479.12	10.23	491.61	9.88	474.93	1.01E+00	1.12E+02	2.33E+00
Antimony	SB05	0.04	0.02	0.13	1.34	0.13	1.30	1.18E-02	2.73E-01	2.73E-02
Arsenic	SB05	15.40	6.43	0.40	5.46	0.38	5.28	1.22E+00	3.88E+01	2.82E+00
Barium	SB05	20.31	8.49	6.44	24.66	6.22	23.83	3.56E-01	3.16E+00	8.23E-01
Beryllium	SB05	3.91E-02	1.64E-02	0.00	0.00	0.00	0.00			
Cadmium	SB05	0.02	0.01	0.06	2.85	0.06	2.75	3.55E-03	3.60E-01	8.20E-03
Chromium	SB05	1.59	0.67	4.09	16.37	3.95	15.81	4.21E-02	3.90E-01	9.74E-02
Copper	SB05	11.86	4.96	2.87	671.02	2.77	648.25	7.65E-03	4.13E+00	1.77E-02
Lead	SB05	3.44	1.44	0.00	251.44	0.00	242.91	5.92E-03	1.90E+03	1.37E-02
Mercury	SB05	0.18	0.07	0.30	5.04	0.29	4.87	1.53E-02	5.94E-01	3.53E-02

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	High Dose (mg/kg/day)	Low Dose (mg/kg/day)	High Dose Low TRV (mg/kg/day)[a]	High Dose High TRV (mg/kg/day)[b]	Low Dose Low TRV (mg/kg/day)c	Low Dose High TRV (mg/kg/day)d	HQ_1 (Low Dose/ High TRV)	HQ_2 (High Dose/ Low TRV)	HQ_3 (High Dose/ High TRV)
Molybdenum	SB05	1.83	0.76	0.28	2.79	0.27	2.70	2.83E-01	6.54E+00	6.54E-01
Selenium	SB05	1.38	0.58	0.05	1.29	0.05	1.24	4.65E-01	2.60E+01	1.08E+00
Silver	SB05	0.36	0.15	0.00	0.00	0.00	0.00			
Zinc	SB05	68.80	28.75	10.23	491.61	9.88	474.93	6.05E-02	6.73E+00	1.40E-01
Antimony	SB06	0.03	0.01	0.13	1.34	0.13	1.30	1.11E-02	2.57E-01	2.57E-02
Arsenic	SB06	11.10	4.64	0.40	5.46	0.38	5.28	8.79E-01	2.79E+01	2.03E+00
Barium	SB06	30.21	12.62	6.44	24.66	6.22	23.83	5.30E-01	4.69E+00	1.22E+00
Beryllium	SB06	5.19E-02	2.17E-02	0.00	0.00	0.00	0.00			
Cadmium	SB06	0.02	0.01	0.06	2.85	0.06	2.75	3.04E-03	3.09E-01	7.03E-03
Chromium	SB06	2.30	0.96	4.09	16.37	3.95	15.81	6.08E-02	5.63E-01	1.41E-01
Copper	SB06	8.40	3.51	2.87	671.02	2.77	648.25	5.41E-03	2.93E+00	1.25E-02
Lead	SB06	1.14	0.48	0.00	251.44	0.00	242.91	1.97E-03	6.32E+02	4.55E-03
Mercury	SB06	0.13	0.05	0.30	5.04	0.29	4.87	1.09E-02	4.24E-01	2.52E-02
Molybdenum	SB06	1.60	0.67	0.28	2.79	0.27	2.70	2.48E-01	5.74E+00	5.74E-01
Selenium	SB06	1.27	0.53	0.05	1.29	0.05	1.24	4.26E-01	2.39E+01	9.86E-01
Silver	SB06	0.31	0.13	0.00	0.00	0.00	0.00			
Zinc	SB06	22.99	9.61	10.23	491.61	9.88	474.93	2.02E-02	2.25E+00	4.68E-02
Antimony	SB07	0.04	0.02	0.13	1.34	0.13	1.30	1.21E-02	2.81E-01	2.81E-02
Arsenic	SB07	10.92	4.56	0.40	5.46	0.38	5.28	8.65E-01	2.75E+01	2.00E+00
Barium	SB07	16.73	6.99	6.44	24.66	6.22	23.83	2.93E-01	2.60E+00	6.78E-01
Beryllium	SB07	4.55E-02	1.90E-02	0.00	0.00	0.00	0.00			
Cadmium	SB07	0.02	0.01	0.06	2.85	0.06	2.75	3.55E-03	3.60E-01	8.20E-03
Chromium	SB07	1.85	0.77	4.09	16.37	3.95	15.81	4.88E-02	4.52E-01	1.13E-01
Copper	SB07	12.74	5.32	2.87	671.02	2.77	648.25	8.21E-03	4.44E+00	1.90E-02
Lead	SB07	3.15	1.32	0.00	251.44	0.00	242.91	5.42E-03	1.74E+03	1.25E-02
Mercury	SB07	0.15	0.06	0.30	5.04	0.29	4.87	1.31E-02	5.09E-01	3.03E-02
Molybdenum	SB07	1.75	0.73	0.28	2.79	0.27	2.70	2.71E-01	6.27E+00	6.27E-01
Selenium	SB07	1.40	0.58	0.05	1.29	0.05	1.24		2.63E+01	1.09E+00
Silver	SB07	0.33	0.14	0.00	0.00	0.00	0.00			
Zinc	SB07	65.52	27.38	10.23	491.61	9.88	474.93	5.76E-02	6.40E+00	1.33E-01
Antimony	SB08	0.04	0.02	0.13	1.34	0.13	1.30	1.18E-02	2.73E-01	2.73E-02
Arsenic	SB08	18.26	7.63	0.40	5.46	0.38	5.28	1.45E+00	4.60E+01	3.34E+00
Barium	SB08	25.13	10.50	6.44	24.66	6.22	23.83	4.41E-01	3.91E+00	1.02E+00
Beryllium	SB08	5.28E-02	2.21E-02	0.00	0.00	0.00	0.00			
Cadmium	SB08	0.02	0.01	0.06	2.85	0.06	2.75	3.55E-03	3.60E-01	8.20E-03
Chromium	SB08	2.65	1.11	4.09	16.37	3.95	15.81	7.00E-02	6.48E-01	1.62E-01
Copper	SB08	16.33	6.82	2.87	671.02	2.77	648.25	1.05E-02	5.69E+00	2.43E-02
Lead	SB08	2.21	0.92	0.00	251.44	0.00	242.91	3.80E-03	1.22E+03	8.78E-03
Mercury	SB08	0.15	0.06	0.30	5.04	0.29	4.87	1.31E-02	5.09E-01	3.03E-02
Molybdenum	SB08	4.21	1.76	0.28	2.79	0.27	2.70	6.51E-01	1.51E+01	1.51E+00
Selenium	SB08	0.56	0.23	0.05	1.29	0.05	1.24	1.89E-01	1.06E+01	4.36E-01
Silver	SB08	0.33	0.14	0.00	0.00	0.00	0.00			
Zinc	SB08	54.00	22.56	10.23	491.61	9.88	474.93	4.75E-02	5.28E+00	1.10E-01
Antimony	SB09	1.29	0.54	0.13	1.34	0.13	1.30	4.16E-01	9.62E+00	9.62E-01
Arsenic	SB09	67.68	28.28	0.40	5.46	0.38	5.28	5.36E+00	1.70E+02	1.24E+01
Barium	SB09	32.54	13.60	6.44	24.66	6.22	23.83	5.71E-01	5.06E+00	1.32E+00
Beryllium	SB09	3.73E-02	1.56E-02	0.00	0.00	0.00	0.00			
Cadmium	SB09	2.20	0.92	0.06	2.85	0.06	2.75	3.34E-01	3.40E+01	7.73E-01
Chromium	SB09	3.75	1.57	4.09	16.37	3.95	15.81	9.92E-02	9.19E-01	2.29E-01
Copper	SB09	136.58	57.07	2.87	671.02	2.77	648.25	8.80E-02	4.76E+01	2.04E-01

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	High Dose (mg/kg/day)	Low Dose (mg/kg/day)	High Dose Low TRV (mg/kg/day)[a]	High Dose High TRV (mg/kg/day)[b]	Low Dose Low TRV (mg/kg/day)c	Low Dose High TRV (mg/kg/day)d	HQ_1 (Low Dose/ High TRV)	HQ_2 (High Dose/ Low TRV)	HQ_3 (High Dose/ High TRV)
Lead	SB09	26.69	11.15	0.00	251.44	0.00	242.91	4.59E-02	1.47E+04	1.06E-01
Mercury	SB09	11.20	4.68	0.30	5.04	0.29	4.87	9.61E-01	3.73E+01	2.22E+00
Molybdenum	SB09	10.52	4.40	0.28	2.79	0.27	2.70	1.63E+00	3.76E+01	3.76E+00
Selenium	SB09	7.28	3.04	0.05	1.29	0.05	1.24	2.45E+00	1.37E+02	5.66E+00
Silver	SB09	0.50	0.21	0.00	0.00	0.00	0.00			
Zinc	SB09	2953.86	1234.29	10.23	491.61	9.88	474.93	2.60E+00	2.89E+02	6.01E+00
Antimony	SB10	6.94	2.90	0.13	1.34	0.13	1.30	2.23E+00	5.16E+01	5.16E+00
Arsenic	SB10	60.88	25.44	0.40	5.46	0.38	5.28	4.82E+00	1.53E+02	1.11E+01
Barium	SB10	25.13	10.50	6.44	24.66	6.22	23.83	4.41E-01	3.91E+00	1.02E+00
Beryllium	SB10	3.73E-02	1.56E-02	0.00	0.00	0.00	0.00			
Cadmium	SB10	8.93	3.73	0.06	2.85	0.06	2.75	1.36E+00	1.38E+02	3.14E+00
Chromium	SB10	8.71	3.64	4.09	16.37	3.95	15.81	2.30E-01	2.13E+00	5.32E-01
Copper	SB10	5220.83	2181.56	2.87	671.02	2.77	648.25	3.37E+00	1.82E+03	7.78E+00
Lead	SB10	32.00	13.37	0.00	251.44	0.00	242.91	5.50E-02	1.77E+04	1.27E-01
Mercury	SB10	3.51	1.47	0.30	5.04	0.29	4.87	3.01E-01	1.17E+01	6.97E-01
Molybdenum	SB10	12.53	5.23	0.28	2.79	0.27	2.70	1.94E+00	4.48E+01	4.48E+00
Selenium	SB10	5.82	2.43	0.05	1.29	0.05	1.24	1.96E+00	1.10E+02	4.53E+00
Silver	SB10	0.36	0.15	0.00	0.00	0.00	0.00			
Zinc	SB10	2708.16	1131.62	10.23	491.61	9.88	474.93	2.38E+00	2.65E+02	5.51E+00
Antimony	SB105	0.10	0.04	0.13	1.34	0.13	1.30	3.19E-02	7.38E-01	7.38E-02
Arsenic	SB105	0.85	0.36	0.40	5.46	0.38	5.28	6.74E-02	2.14E+00	1.56E-01
Barium	SB105	17.06	7.13	6.44	24.66	6.22	23.83	2.99E-01	2.65E+00	6.92E-01
Beryllium	SB105	1.18E-03	4.94E-04	0.00	0.00	0.00	0.00			
Cadmium	SB105	0.03	0.01	0.06	2.85	0.06	2.75	4.00E-03	4.07E-01	9.25E-03
Chromium	SB105	1.29	0.54	4.09	16.37	3.95	15.81	3.41E-02	3.16E-01	7.88E-02
Copper	SB105	15.50	6.47	2.87	671.02	2.77	648.25	9.99E-03	5.40E+00	2.31E-02
Lead	SB105	0.43	0.18	0.00	251.44	0.00	242.91	7.33E-04	2.35E+02	1.69E-03
Mercury	SB105	0.15	0.06	0.30	5.04	0.29	4.87	1.31E-02	5.09E-01	3.03E-02
Molybdenum	SB105	1.00	0.42	0.28	2.79	0.27	2.70	1.55E-01	3.59E+00	3.59E-01
Selenium	SB105	0.87	0.37	0.05	1.29	0.05	1.24	2.94E-01	1.64E+01	6.80E-01
Silver	SB105	0.11	0.05	0.00	0.00	0.00	0.00			
Zinc	SB105	40.57	16.95	10.23	491.61	9.88	474.93	3.57E-02	3.97E+00	8.25E-02
Antimony	SB11	0.04	0.02	0.13	1.34	0.13	1.30	1.32E-02	3.05E-01	3.05E-02
Arsenic	SB11	26.32	11.00	0.40	5.46	0.38	5.28	2.08E+00	6.62E+01	4.82E+00
Barium	SB11	17.48	7.30	6.44	24.66	6.22	23.83	3.06E-01	2.72E+00	7.09E-01
Beryllium	SB11	4.10E-02	1.71E-02	0.00	0.00	0.00	0.00			
Cadmium	SB11	0.03	0.01	0.06	2.85	0.06	2.75	4.05E-03	4.12E-01	9.37E-03
Chromium	SB11	2.59	1.08	4.09	16.37	3.95	15.81	6.84E-02	6.33E-01	1.58E-01
Copper	SB11	20.97	8.76	2.87	671.02	2.77	648.25	1.35E-02	7.31E+00	3.12E-02
Lead	SB11	5.44	2.27	0.00	251.44	0.00	242.91	9.36E-03	3.00E+03	2.16E-02
Mercury	SB11	0.15	0.06	0.30	5.04	0.29	4.87	1.31E-02	5.09E-01	3.03E-02
Molybdenum	SB11	1.88	0.79	0.28	2.79	0.27	2.70	2.91E-01	6.72E+00	6.72E-01
Selenium	SB11	1.46	0.61	0.05	1.29	0.05	1.24	4.90E-01	2.74E+01	1.13E+00
Silver	SB11	0.38	0.16	0.00	0.00	0.00	0.00			
Zinc	SB11	84.08	35.14	10.23	491.61	9.88	474.93	7.40E-02	8.22E+00	1.71E-01
Antimony	SB12	1.08	0.45	0.13	1.34	0.13	1.30	3.47E-01	8.02E+00	8.02E-01
Arsenic	SB12	11.82	4.94	0.40	5.46	0.38	5.28	9.36E-01	2.97E+01	2.16E+00
Barium	SB12	33.62	14.05	6.44	24.66	6.22	23.83	5.90E-01	5.22E+00	1.36E+00
Beryllium	SB12	4.73E-02	1.98E-02	0.00	0.00	0.00	0.00			
Cadmium	SB12	0.02	0.01	0.06	2.85	0.06	2.75	3.55E-03	3.60E-01	8.20E-03

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	High Dose (mg/kg/day)	Low Dose (mg/kg/day)	High Dose Low TRV (mg/kg/day)[a]	High Dose High TRV (mg/kg/day)[b]	Low Dose Low TRV (mg/kg/day)c	Low Dose High TRV (mg/kg/day)d	HQ_1 (Low Dose/ High TRV)	HQ_2 (High Dose/ Low TRV)	HQ_3 (High Dose/ High TRV)
Chromium	SB12	2.40	1.00	4.09	16.37	3.95	15.81	6.35E-02	5.88E-01	1.47E-01
Copper	SB12	29.95	12.51	2.87	671.02	2.77	648.25	1.93E-02	1.04E+01	4.46E-02
Lead	SB12	12.82	5.36	0.00	251.44	0.00	242.91	2.20E-02	7.08E+03	5.10E-02
Mercury	SB12	0.15	0.06	0.30	5.04	0.29	4.87	1.31E-02	5.09E-01	3.03E-02
Molybdenum	SB12	1.83	0.76	0.28	2.79	0.27	2.70	2.83E-01	6.54E+00	6.54E-01
Selenium	SB12	1.60	0.67	0.05	1.29	0.05	1.24	5.39E-01	3.02E+01	1.25E+00
Silver	SB12	0.36	0.15	0.00	0.00	0.00	0.00			
Zinc	SB12	107.02	44.72	10.23	491.61	9.88	474.93	9.42E-02	1.05E+01	2.18E-01
Antimony	SB13	0.54	0.23	0.13	1.34	0.13	1.30	1.73E-01	4.01E+00	4.01E-01
Arsenic	SB13	35.27	14.74	0.40	5.46	0.38	5.28	2.79E+00	8.88E+01	6.46E+00
Barium	SB13	56.59	23.65	6.44	24.66	6.22	23.83	9.92E-01	8.79E+00	2.29E+00
Beryllium	SB13	8.19E-04	3.42E-04	0.00	0.00	0.00	0.00			
Cadmium	SB13	0.02	0.01	0.06	2.85	0.06	2.75	3.60E-03	3.65E-01	8.32E-03
Chromium	SB13	3.95	1.65	4.09	16.37	3.95	15.81	1.05E-01	9.68E-01	2.42E-01
Copper	SB13	430.20	179.76	2.87	671.02	2.77	648.25	2.77E-01	1.50E+02	6.41E-01
Lead	SB13	10.22	4.27	0.00	251.44	0.00	242.91	1.76E-02	5.64E+03	4.06E-02
Mercury	SB13	1.99	0.83	0.30	5.04	0.29	4.87	1.70E-01	6.62E+00	3.94E-01
Molybdenum	SB13	1508.14	630.19	0.28	2.79	0.27	2.70	2.33E+02	5.40E+03	5.40E+02
Selenium	SB13	3.49	1.46	0.05	1.29	0.05	1.24	1.18E+00	6.58E+01	2.72E+00
Silver	SB13	1.04	0.44	0.00	0.00	0.00	0.00			
Zinc	SB13	497.95	208.07	10.23	491.61	9.88	474.93	4.38E-01	4.87E+01	1.01E+00
Antimony	SB14	1.38	0.58	0.13	1.34	0.13	1.30	4.44E-01	1.03E+01	1.03E+00
Arsenic	SB14	109.93	45.94	0.40	5.46	0.38	5.28	8.71E+00	2.77E+02	2.01E+01
Barium	SB14	94.87	39.64	6.44	24.66	6.22	23.83	1.66E+00	1.47E+01	3.85E+00
Beryllium	SB14	8.19E-04	3.42E-04	0.00	0.00	0.00	0.00			
Cadmium	SB14	0.02	0.01	0.06	2.85	0.06	2.75	3.55E-03	3.60E-01	8.20E-03
Chromium	SB14	6.79	2.84	4.09	16.37	3.95	15.81	1.80E-01	1.66E+00	4.15E-01
Copper	SB14	112.77	47.12	2.87	671.02	2.77	648.25	7.27E-02	3.93E+01	1.68E-01
Lead	SB14	56.12	23.45	0.00	251.44	0.00	242.91	9.65E-02	3.10E+04	2.23E-01
Mercury	SB14	0.41	0.17	0.30	5.04	0.29	4.87	3.49E-02	1.36E+00	8.08E-02
Molybdenum	SB14	25.05	10.47	0.28	2.79	0.27	2.70	3.88E+00	8.96E+01	8.96E+00
Selenium	SB14	11.36	4.75	0.05	1.29	0.05	1.24	3.82E+00	2.14E+02	8.84E+00
Silver	SB14	1.09	0.45	0.00	0.00	0.00	0.00			
Zinc	SB14	906.36	378.73	10.23	491.61	9.88	474.93	7.97E-01	8.86E+01	1.84E+00
Antimony	SB15	5.67	2.37	0.13	1.34	0.13	1.30	1.82E+00	4.22E+01	4.22E+00
Arsenic	SB15	103.31	43.17	0.40	5.46	0.38	5.28	8.18E+00	2.60E+02	1.89E+01
Barium	SB15	56.84	23.75	6.44	24.66	6.22	23.83	9.97E-01	8.83E+00	2.30E+00
Beryllium	SB15	1.46E-03	6.08E-04	0.00	0.00	0.00	0.00			
Cadmium	SB15	0.04	0.02	0.06	2.85	0.06	2.75	6.59E-03	6.69E-01	1.52E-02
Chromium	SB15	260.46	108.84	4.09	16.37	3.95	15.81	6.88E+00	6.38E+01	1.59E+01
Copper	SB15	303.23	126.71	2.87	671.02	2.77	648.25	1.95E-01	1.06E+02	4.52E-01
Lead	SB15	17.45	7.29	0.00	251.44	0.00	242.91	3.00E-02	9.64E+03	6.94E-02
Mercury	SB15	0.79	0.33	0.30	5.04	0.29	4.87	6.77E-02	2.63E+00	1.57E-01
Molybdenum	SB15	38.58	16.12	0.28	2.79	0.27	2.70	5.97E+00	1.38E+02	1.38E+01
Selenium	SB15	9.90	4.14	0.05	1.29	0.05	1.24	3.33E+00	1.86E+02	7.70E+00
Silver	SB15	1.17	0.49	0.00	0.00	0.00	0.00			
Zinc	SB15	840.84	351.35	10.23	491.61	9.88	474.93	7.40E-01	8.22E+01	1.71E+00
Antimony	SB16	0.31	0.13	0.13	1.34	0.13	1.30	1.01E-01	2.32E+00	2.32E-01
Arsenic	SB16	17.01	7.11	0.40	5.46	0.38	5.28	1.35E+00	4.28E+01	3.11E+00
Barium	SB16	10.24	4.28	6.44	24.66	6.22	23.83	1.80E-01	1.59E+00	4.15E-01

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	High Dose (mg/kg/day)	Low Dose (mg/kg/day)	High Dose Low TRV (mg/kg/day)[a]	High Dose High TRV (mg/kg/day)[b]	Low Dose Low TRV (mg/kg/day)c	Low Dose High TRV (mg/kg/day)d	HQ_1 (Low Dose/ High TRV)	HQ_2 (High Dose/ Low TRV)	HQ_3 (High Dose/ High TRV)
Beryllium	SB16	4.50E-03	1.88E-03	0.00	0.00	0.00	0.00			
Cadmium	SB16	0.13	0.06	0.06	2.85	0.06	2.75	2.03E-02	2.06E+00	4.68E-02
Chromium	SB16	0.08	0.03	4.09	16.37	3.95	15.81	2.05E-03	1.90E-02	4.74E-03
Copper	SB16	0.46	0.19	2.87	671.02	2.77	648.25	2.96E-04	1.60E-01	6.85E-04
Lead	SB16	0.03	0.01	0.00	251.44	0.00	242.91	5.00E-05	1.61E+01	1.16E-04
Mercury	SB16	2.52	1.05	0.30	5.04	0.29	4.87	2.16E-01	8.40E+00	5.00E-01
Molybdenum	SB16	6.01	2.51	0.28	2.79	0.27	2.70	9.31E-01	2.15E+01	2.15E+00
Selenium	SB16	2.91	1.22	0.05	1.29	0.05	1.24	9.80E-01	5.48E+01	2.27E+00
Silver	SB16	0.23	0.10	0.00	0.00	0.00	0.00			
Zinc	SB16	1.75	0.73	10.23	491.61	9.88	474.93	1.54E-03	1.71E-01	3.55E-03
Antimony	SB17	0.08	0.04	0.13	1.34	0.13	1.30	2.70E-02	6.25E-01	6.25E-02
Arsenic	SB17	0.61	0.25	0.40	5.46	0.38	5.28	4.82E-02	1.53E+00	1.11E-01
Barium	SB17	0.47	0.19	6.44	24.66	6.22	23.83	8.17E-03	7.24E-02	1.89E-02
Beryllium	SB17	6.37E-04	2.66E-04	0.00	0.00	0.00	0.00			
Cadmium	SB17	0.02	0.01	0.06	2.85	0.06	2.75	2.74E-03	2.78E-01	6.32E-03
Chromium	SB17	15.16	6.33	4.09	16.37	3.95	15.81	4.01E-01	3.71E+00	9.26E-01
Copper	SB17	215.10	89.88	2.87	671.02	2.77	648.25	1.39E-01	7.49E+01	3.21E-01
Lead	SB17	34.74	14.51	0.00	251.44	0.00	242.91	5.98E-02	1.92E+04	1.38E-01
Mercury	SB17	0.36	0.15	0.30	5.04	0.29	4.87	3.06E-02	1.19E+00	7.07E-02
Molybdenum	SB17	34.57	14.45	0.28	2.79	0.27	2.70	5.35E+00	1.24E+02	1.24E+01
Selenium	SB17	17.47	7.30	0.05	1.29	0.05	1.24	5.88E+00	3.29E+02	1.36E+01
Silver	SB17	0.03	0.01	0.00	0.00	0.00	0.00			
Zinc	SB17	1124.76	469.99	10.23	491.61	9.88	474.93	9.90E-01	1.10E+02	2.29E+00
Antimony	SB18	1.25	0.52	0.13	1.34	0.13	1.30	4.02E-01	9.30E+00	9.30E-01
Arsenic	SB18	189.79	79.30	0.40	5.46	0.38	5.28	1.50E+01	4.78E+02	3.47E+01
Barium	SB18	16.15	6.75	6.44	24.66	6.22	23.83	2.83E-01	2.51E+00	6.55E-01
Beryllium	SB18	1.05E-03	4.37E-04	0.00	0.00	0.00	0.00			
Cadmium	SB18	0.03	0.01	0.06	2.85	0.06	2.75	4.66E-03	4.73E-01	1.08E-02
Chromium	SB18	4.17	1.74	4.09	16.37	3.95	15.81	1.10E-01	1.02E+00	2.55E-01
Copper	SB18	697.50	291.46	2.87	671.02	2.77	648.25	4.50E-01	2.43E+02	1.04E+00
Lead	SB18	21.73	9.08	0.00	251.44	0.00	242.91	3.74E-02	1.20E+04	8.64E-02
Mercury	SB18	0.56	0.23	0.30	5.04	0.29	4.87	4.80E-02	1.87E+00	1.11E-01
Molybdenum	SB18	33.07	13.82	0.28	2.79	0.27	2.70	5.12E+00	1.18E+02	1.18E+01
Selenium	SB18	11.07	4.62	0.05	1.29	0.05	1.24	3.72E+00	2.08E+02	8.61E+00
Silver	SB18	0.05	0.02	0.00	0.00	0.00	0.00			
Zinc	SB18	616.98	257.81	10.23	491.61	9.88	474.93	5.43E-01	6.03E+01	1.26E+00
Antimony	SB19	0.82	0.34	0.13	1.34	0.13	1.30	2.64E-01	6.09E+00	6.09E-01
Arsenic	SB19	94.36	39.43	0.40	5.46	0.38	5.28	7.47E+00	2.37E+02	1.73E+01
Barium	SB19	15.31	6.40	6.44	24.66	6.22	23.83	2.69E-01	2.38E+00	6.21E-01
Beryllium	SB19	7.28E-04	3.04E-04	0.00	0.00	0.00	0.00			
Cadmium	SB19	0.02	0.01	0.06	2.85	0.06	2.75	3.29E-03	3.34E-01	7.61E-03
Chromium	SB19	7.40	3.09	4.09	16.37	3.95	15.81	1.96E-01	1.81E+00	4.52E-01
Copper	SB19	180.43	75.39	2.87	671.02	2.77	648.25	1.16E-01	6.29E+01	2.69E-01
Lead	SB19	28.06	11.73	0.00	251.44	0.00	242.91	4.83E-02	1.55E+04	1.12E-01
Mercury	SB19	0.43	0.18	0.30	5.04	0.29	4.87	3.71E-02	1.44E+00	8.58E-02
Molybdenum	SB19	30.06	12.56	0.28	2.79	0.27	2.70	4.65E+00	1.08E+02	1.08E+01
Selenium	SB19	16.74	7.00	0.05	1.29	0.05	1.24	5.63E+00	3.15E+02	1.30E+01
Silver	SB19	0.04	0.02	0.00	0.00	0.00	0.00			
Zinc	SB19	402.40	168.15	10.23	491.61	9.88	474.93	3.54E-01	3.93E+01	8.19E-01
Antimony	SB20	0.58	0.24	0.13	1.34	0.13	1.30	1.87E-01	4.33E+00	4.33E-01

APPENDIX I1

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	High Dose (mg/kg/day)	Low Dose (mg/kg/day)	High Dose Low TRV (mg/kg/day)[a]	High Dose High TRV (mg/kg/day)[b]	Low Dose Low TRV (mg/kg/day)c	Low Dose High TRV (mg/kg/day)d	HQ_1 (Low Dose/ High TRV)	HQ_2 (High Dose/ Low TRV)	HQ_3 (High Dose/ High TRV)
Arsenic	SB20	41.00	17.13	0.40	5.46	0.38	5.28	3.25E+00	1.03E+02	7.51E+00
Barium	SB20	27.96	11.68	6.44	24.66	6.22	23.83	4.90E-01	4.34E+00	1.13E+00
Beryllium	SB20	6.83E-04	2.85E-04	0.00	0.00	0.00	0.00			
Cadmium	SB20	0.02	0.01	0.06	2.85	0.06	2.75	3.04E-03	3.09E-01	7.03E-03
Chromium	SB20	6.50	2.72	4.09	16.37	3.95	15.81	1.72E-01	1.59E+00	3.97E-01
Copper	SB20	826.98	345.56	2.87	671.02	2.77	648.25	5.33E-01	2.88E+02	1.23E+00
Lead	SB20	20.19	8.44	0.00	251.44	0.00	242.91	3.47E-02	1.11E+04	8.03E-02
Mercury	SB20	3.26	1.36	0.30	5.04	0.29	4.87	2.80E-01	1.09E+01	6.46E-01
Molybdenum	SB20	14.53	6.07	0.28	2.79	0.27	2.70	2.25E+00	5.20E+01	5.20E+00
Selenium	SB20	6.12	2.56	0.05	1.29	0.05	1.24	2.06E+00	1.15E+02	4.76E+00
Silver	SB20	0.04	0.01	0.00	0.00	0.00	0.00			
Zinc	SB20	982.80	410.67	10.23	491.61	9.88	474.93	8.65E-01	9.61E+01	2.00E+00
Antimony	SS206	0.26	0.11	0.13	1.34	0.13	1.30	8.32E-02	1.92E+00	1.92E-01
Arsenic	SS206	13.79	5.76	0.40	5.46	0.38	5.28	1.09E+00	3.47E+01	2.52E+00
Barium	SS206	17.89	7.48	6.44	24.66	6.22	23.83	3.14E-01	2.78E+00	7.25E-01
Beryllium	SS206	3.00E-04	1.25E-04	0.00	0.00	0.00	0.00			
Cadmium	SS206	1.07	0.45	0.06	2.85	0.06	2.75	1.62E-01	1.65E+01	3.75E-01
Chromium	SS206	2.52	1.05	4.09	16.37	3.95	15.81	6.65E-02	6.16E-01	1.54E-01
Copper	SS206	235.98	98.61	2.87	671.02	2.77	648.25	1.52E-01	8.22E+01	3.52E-01
Lead	SS206	8.32	3.47	0.00	251.44	0.00	242.91	1.43E-02	4.59E+03	3.31E-02
Mercury	SS206	0.13	0.05	0.30	5.04	0.29	4.87	1.09E-02	4.24E-01	2.52E-02
Molybdenum	SS206	3.36	1.40	0.28	2.79	0.27	2.70	5.20E-01	1.20E+01	1.20E+00
Selenium	SS206	0.15	0.06	0.05	1.29	0.05	1.24	4.90E-02	2.74E+00	1.13E-01
Silver	SS206	2.80	1.17	0.00	0.00	0.00	0.00			
Zinc	SS206	536.72	224.27	10.23	491.61	9.88	474.93	4.72E-01	5.25E+01	1.09E+00
Antimony	SS210			0.13	1.34	0.13	1.30			
Arsenic	SS210	8.42	3.52	0.40	5.46	0.38	5.28	6.66E-01	2.12E+01	1.54E+00
Barium	SS210	9.15	3.83	6.44	24.66	6.22	23.83	1.61E-01	1.42E+00	3.71E-01
Beryllium	SS210	2.73E-04	1.14E-04	0.00	0.00	0.00	0.00			
Cadmium	SS210	0.25	0.11	0.06	2.85	0.06	2.75	3.85E-02	3.91E+00	8.90E-02
Chromium	SS210	2.03	0.85	4.09	16.37	3.95	15.81	5.36E-02	4.97E-01	1.24E-01
Copper	SS210	5.55	2.32	2.87	671.02	2.77	648.25	3.58E-03	1.94E+00	8.28E-03
Lead	SS210	0.51	0.21	0.00	251.44	0.00	242.91	8.77E-04	2.82E+02	2.03E-03
Mercury	SS210	0.13	0.05	0.30	5.04	0.29	4.87	1.09E-02	4.24E-01	2.52E-02
Molybdenum	SS210	0.45	0.19	0.28	2.79	0.27	2.70	6.98E-02	1.61E+00	1.61E-01
Selenium	SS210	0.31	0.13	0.05	1.29	0.05	1.24	1.03E-01	5.76E+00	2.38E-01
Silver	SS210	0.02	0.01	0.00	0.00	0.00	0.00			
Zinc	SS210	38.44	16.06	10.23	491.61	9.88	474.93	3.38E-02	3.76E+00	7.82E-02
Antimony	SS211			0.13	1.34	0.13	1.30			
Arsenic	SS211	5.55	2.32	0.40	5.46	0.38	5.28	4.40E-01	1.40E+01	1.02E+00
Barium	SS211	10.40	4.35	6.44	24.66	6.22	23.83	1.82E-01	1.62E+00	4.22E-01
Beryllium	SS211	2.73E-04	1.14E-04	0.00	0.00	0.00	0.00			
Cadmium	SS211	0.01	0.00	0.06	2.85	0.06	2.75	8.61E-04	8.75E-02	1.99E-03
Chromium	SS211	1.43	0.60	4.09	16.37	3.95	15.81	3.78E-02	3.50E-01	8.73E-02
Copper	SS211	3.84	1.61	2.87	671.02	2.77	648.25	2.48E-03	1.34E+00	5.73E-03
Lead	SS211	0.76	0.32	0.00	251.44	0.00	242.91	1.31E-03	4.20E+02	3.03E-03
Mercury	SS211	0.10	0.04	0.30	5.04	0.29	4.87	8.73E-03	3.40E-01	2.02E-02
Molybdenum	SS211	0.45	0.19	0.28	2.79	0.27	2.70	6.98E-02	1.61E+00	1.61E-01
Selenium	SS211	0.13	0.05	0.05	1.29	0.05	1.24	4.41E-02	2.47E+00	1.02E-01
Silver	SS211	0.02	0.01	0.00	0.00	0.00	0.00			

APPENDIX I1

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	High Dose (mg/kg/day)	Low Dose (mg/kg/day)	High Dose Low TRV (mg/kg/day)[a]	High Dose High TRV (mg/kg/day)[b]	Low Dose Low TRV (mg/kg/day)c	Low Dose High TRV (mg/kg/day)d	HQ_1 (Low Dose/ High TRV)	HQ_2 (High Dose/ Low TRV)	HQ_3 (High Dose/ High TRV)
Zinc	SS211	25.39	10.61	10.23	491.61	9.88	474.93	2.23E-02	2.48E+00	5.16E-02
Antimony	SS212	0.13	0.05	0.13	1.34	0.13	1.30	4.16E-02	9.62E-01	9.62E-02
Arsenic	SS212	5.55	2.32	0.40	5.46	0.38	5.28	4.40E-01	1.40E+01	1.02E+00
Barium	SS212	7.59	3.17	6.44	24.66	6.22	23.83	1.33E-01	1.18E+00	3.08E-01
Beryllium	SS212	9.10E-04	3.80E-04	0.00	0.00	0.00	0.00			
Cadmium	SS212	0.24	0.10	0.06	2.85	0.06	2.75	3.65E-02	3.70E+00	8.43E-02
Chromium	SS212	2.72	1.14	4.09	16.37	3.95	15.81	7.18E-02	6.65E-01	1.66E-01
Copper	SS212	8.19	3.42	2.87	671.02	2.77	648.25	5.28E-03	2.85E+00	1.22E-02
Lead	SS212	0.96	0.40	0.00	251.44	0.00	242.91	1.66E-03	5.32E+02	3.83E-03
Mercury	SS212	0.13	0.05	0.30	5.04	0.29	4.87	1.09E-02	4.24E-01	2.52E-02
Molybdenum	SS212	0.40	0.17	0.28	2.79	0.27	2.70	6.20E-02	1.43E+00	1.43E-01
Selenium	SS212	0.12	0.05	0.05	1.29	0.05	1.24	4.16E-02	2.33E+00	9.63E-02
Silver	SS212	0.01	0.01	0.00	0.00	0.00	0.00			
Zinc	SS212	56.78	23.73	10.23	491.61	9.88	474.93	5.00E-02	5.55E+00	1.16E-01
Antimony	SS213			0.13	1.34	0.13	1.30			
Arsenic	SS213	13.25	5.54	0.40	5.46	0.38	5.28	1.05E+00	3.33E+01	2.43E+00
Barium	SS213	9.82	4.10	6.44	24.66	6.22	23.83	1.72E-01	1.53E+00	3.98E-01
Beryllium	SS213	2.28E-04	9.51E-05	0.00	0.00	0.00	0.00			
Cadmium	SS213	0.46	0.19	0.06	2.85	0.06	2.75	6.99E-02	7.10E+00	1.62E-01
Chromium	SS213	2.10	0.88	4.09	16.37	3.95	15.81	5.55E-02	5.14E-01	1.28E-01
Copper	SS213	23.85	9.97	2.87	671.02	2.77	648.25	1.54E-02	8.31E+00	3.55E-02
Lead	SS213	1.88	0.79	0.00	251.44	0.00	242.91	3.24E-03	1.04E+03	7.49E-03
Mercury	SS213	1.27	0.53	0.30	5.04	0.29	4.87	1.09E-01	4.24E+00	2.52E-01
Molybdenum	SS213	0.40	0.17	0.28	2.79	0.27	2.70	6.20E-02	1.43E+00	1.43E-01
Selenium	SS213	0.12	0.05	0.05	1.29	0.05	1.24	4.16E-02	2.33E+00	9.63E-02
Silver	SS213	0.01	0.01	0.00	0.00	0.00	0.00			
Zinc	SS213	184.00	76.89	10.23	491.61	9.88	474.93	1.62E-01	1.80E+01	3.74E-01
Antimony	SS214	0.09	0.04	0.13	1.34	0.13	1.30	3.05E-02	7.06E-01	7.06E-02
Arsenic	SS214	14.50	6.06	0.40	5.46	0.38	5.28	1.15E+00	3.65E+01	2.66E+00
Barium	SS214	7.34	3.07	6.44	24.66	6.22	23.83	1.29E-01	1.14E+00	2.98E-01
Beryllium	SS214	2.28E-04	9.51E-05	0.00	0.00	0.00	0.00			
Cadmium	SS214	0.25	0.11	0.06	2.85	0.06	2.75	3.85E-02	3.91E+00	8.90E-02
Chromium	SS214	2.09	0.87	4.09	16.37	3.95	15.81	5.52E-02	5.12E-01	1.28E-01
Copper	SS214	7.31	3.05	2.87	671.02	2.77	648.25		2.55E+00	1.09E-02
Lead	SS214	3.34	1.39	0.00	251.44	0.00	242.91	5.74E-03	1.84E+03	1.33E-02
Mercury	SS214	0.14	0.06	0.30	5.04	0.29	4.87	1.20E-02	4.67E-01	2.78E-02
Molybdenum	SS214	0.50	0.21	0.28	2.79	0.27	2.70	7.75E-02	1.79E+00	1.79E-01
Selenium	SS214	0.25	0.10	0.05	1.29	0.05	1.24	8.33E-02	4.66E+00	1.93E-01
Silver	SS214	0.01	0.01	0.00	0.00	0.00	0.00			
Zinc	SS214	43.13	18.02	10.23	491.61	9.88	474.93	3.80E-02	4.22E+00	8.77E-02
Antimony	UCL 95	0.33	0.14	0.13	1.34	0.13	1.30	1.07E-01	2.46E+00	2.46E-01
Arsenic	UCL 95	14.08	5.88	0.40	5.46	0.38	5.28	1.11E+00	3.54E+01	2.58E+00
Barium	UCL 95	22.10	9.23	6.44	24.66	6.22	23.83	3.88E-01	3.43E+00	8.96E-01
Beryllium	UCL 95	2.03E-02	8.49E-03	0.00	0.00	0.00	0.00			
Cadmium	UCL 95	1.28	0.54	0.06	2.85	0.06	2.75	1.95E-01	1.98E+01	4.50E-01
Chromium	UCL 95	5.64	2.36	4.09	16.37	3.95	15.81	1.49E-01	1.38E+00	3.45E-01
Copper	UCL 95	33.29	13.91	2.87	671.02	2.77	648.25	2.15E-02	1.16E+01	4.96E-02
Lead	UCL 95	17.24	7.21	0.00	251.44	0.00	242.91	2.97E-02	9.52E+03	6.86E-02
Mercury	UCL 95	0.06	0.03	0.30	5.04	0.29	4.87	5.17E-03	2.01E-01	1.19E-02
Molybdenum	UCL 95	3.31	1.38	0.28	2.79	0.27	2.70	5.13E-01	1.19E+01	1.19E+00

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	High Dose (mg/kg/day)	Low Dose (mg/kg/day)	High Dose Low TRV (mg/kg/day)[a]	High Dose High TRV (mg/kg/day)[b]	Low Dose Low TRV (mg/kg/day)c	Low Dose High TRV (mg/kg/day)d	HQ_1 (Low Dose/ High TRV)	HQ_2 (High Dose/ Low TRV)	HQ_3 (High Dose/ High TRV)
Selenium	UCL 95	1.77	0.74	0.05	1.29	0.05	1.24	5.96E-01	3.33E+01	1.38E+00
Silver	UCL 95	0.14	0.06	0.00	0.00	0.00	0.00			
Zinc	UCL 95	207.49	86.70	10.23	491.61	9.88	474.93	1.83E-01	2.03E+01	4.22E-01

Notes:

na Not available
HQ Hazard quotient
mg/kg/day Milligrams per kilogram per day
TRV Toxicity reference value
UCL Upper confidence limit

Allometric TRV Conversions

a High Dose Low TRV = Low Dose $_{test}$ * (low body weight $_{test}$/high dose body weight $_{SMHM}$)$^{1-0.94}$
b High Dose High TRV = High Dose $_{test}$ * (high body weight $_{test}$/high dose body weight $_{SMHM}$)$^{1-0.94}$
c Low Dose Low TRV = Low Dose $_{test}$ * (low body weight $_{test}$/low dose body weight $_{SMHM}$)$^{1-0.94}$
d Low Dose High TRV = High Dose $_{test}$ * (high body weight $_{test}$/low dose body weight $_{SMHM}$)$^{1-0.94}$

DS.0309.15133

APPENDIX I2
SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Antimony	309CSPWSS	High	0.54	0.004	0.00	0.0001	6.72	0.00	1.00	0.009	0.27	0.17	1.69		X	
Arsenic	309CSPWSS	High	31.53	0.004	0.1104	0.0001	57	0.005	1.00	0.009	12.79	0.79	8.79			X
Barium	309CSPWSS	High	39.64	0.004	0.1387	0.0001	646	0.054	1.00	0.009	21.44	13.45	49.44		X	
Beryllium	309CSPWSS	High	0.05	0.004	0.0002	0.0001	0.21	0.000	1.00	0.009	0.02	0.00	0.00			
Cadmium	309CSPWSS	High	3.24	0.004	0.0114	0.0001	7.8	0.001	1.00	0.009	1.33	0.08	3.61		X	
Chromium	309CSPWSS	High	7.12	0.004	0.0249	0.0001	73.4	0.006	1.00	0.009	3.45	8.19	32.81	X		
Copper	309CSPWSS	High	45.05	0.004	0.158	0.0001	311	0.03	1.00	0.009	20.42	3.61	812.91		X	
Lead	309CSPWSS	High	3.78	0.004	0.0132	0.0001	2300	0.19	1.00	0.009	22.94	0.003	288.93		X	
Mercury	309CSPWSS	High	0.09	0.004	0.00032	0.0001	0.18	0.00002	1.00	0.009	0.04	0.30	5.04	X		
Molybdenum	309CSPWSS	High	7.84	0.004	0.0274	0.0001	5.13	0.000	1.00	0.009	3.10	0.35	3.51		X	
Selenium	309CSPWSS	High	4.46	0.004	0.016	0.0001	1.2	0.0001	1.00	0.009	1.75	0.06	1.56			X
Silver	309CSPWSS	High	0.33	0.004	0.0012	0.0001	1.08	0.000	1.00	0.009	0.14	0.00	0.00			
Zinc	309CSPWSS	High	493.69	0.004	1.73	0.0001	2270	0.19	1.00	0.009	213.18	12.47	863.96		X	
Antimony	309CSPWSS	Low	0.54	0.003	0.00	0.0001	6.72	0.00	1.00	0.016	0.11	0.15	1.46	X		
Arsenic	309CSPWSS	Low	31.53	0.003	0.0820	0.0001	57	0.004	1.00	0.016	5.35	0.68	7.61		X	
Barium	309CSPWSS	Low	39.64	0.003	0.1031	0.0001	646	0.040	1.00	0.016	8.96	11.65	42.82	X		
Beryllium	309CSPWSS	Low	0.05	0.003	0.0001	0.0001	0.21	0.000	1.00	0.016	0.01	0.00	0.00			
Cadmium	309CSPWSS	Low	3.24	0.003	0.0084	0.0001	7.8	0.000	1.00	0.016	0.56	0.07	3.12		X	
Chromium	309CSPWSS	Low	7.12	0.003	0.0185	0.0001	73.4	0.005	1.00	0.016	1.44	7.09	28.42	X		
Copper	309CSPWSS	Low	45.05	0.003	0.117	0.0001	311	0.02	1.00	0.016	8.53	3.12	704.00		X	
Lead	309CSPWSS	Low	3.78	0.003	0.0098	0.0001	2300	0.14	1.00	0.016	9.58	0.003	250.22		X	
Mercury	309CSPWSS	Low	0.09	0.003	0.00023	0.0001	0.18	0.00001	1.00	0.016	0.02	0.29	4.87	X		
Molybdenum	309CSPWSS	Low	7.84	0.003	0.0204	0.0001	5.13	0.000	1.00	0.016	1.29	0.30	3.04		X	
Selenium	309CSPWSS	Low	4.46	0.003	0.012	0.0001	1.2	0.0001	1.00	0.016	0.73	0.06	1.35		X	
Silver	309CSPWSS	Low	0.33	0.003	0.0009	0.0001	1.08	0.000	1.00	0.016	0.06	0.00	0.00			
Zinc	309CSPWSS	Low	493.69	0.003	1.28	0.0001	2270	0.14	1.00	0.016	89.08	10.80	748.21		X	
Antimony	309SB05	High	0.14	0.004	0.00	0.0001	1.12	0.00	1.00	0.009	0.07	0.17	1.69	X		
Arsenic	309SB05	High	0.43	0.004	0.0015	0.0001	10.4	0.001	1.00	0.009	0.26	0.79	8.79	X		
Barium	309SB05	High	13.47	0.004	0.0471	0.0001	268	0.023	1.00	0.009	7.74	13.45	49.44	X		
Beryllium	309SB05	High	0.01	0.004	0.0001	0.0001	0.48	0.000	1.00	0.009	0.01	0.00	0.00			
Cadmium	309SB05	High	0.09	0.004	0.0003	0.0001	1.55	0.000	1.00	0.009	0.05	0.08	3.61	X		
Chromium	309SB05	High	2.72	0.004	0.0095	0.0001	32.5	0.003	1.00	0.009	1.36	8.19	32.81	X		
Copper	309SB05	High	13.04	0.004	0.046	0.0001	49	0.00	1.00	0.009	5.53	3.61	812.91		X	
Lead	309SB05	High	2.72	0.004	0.0095	0.0001	162	0.01	1.00	0.009	2.57	0.003	288.93		X	
Mercury	309SB05	High	0.03	0.004	0.00010	0.0001	0.26	0.00002	1.00	0.009	0.01	0.30	5.04	X		
Molybdenum	309SB05	High	2.15	0.004	0.0075	0.0001	0.47	0.000	1.00	0.009	0.84	0.35	3.51		X	
Selenium	309SB05	High	0.07	0.004	0.000	0.0001	0.15	0.0000	1.00	0.009	0.03	0.06	1.56	X		
Silver	309SB05	High	0.08	0.004	0.0003	0.0001	0.563	0.000	1.00	0.009	0.04	0.00	0.00			
Zinc	309SB05	High	40.69	0.004	0.14	0.0001	284	0.02	1.00	0.009	18.47	12.47	863.96		X	
Antimony	309SB05	Low	0.14	0.003	0.00	0.0001	1.12	0.00	1.00	0.016	0.03	0.15	1.46	X		
Arsenic	309SB05	Low	0.43	0.003	0.0011	0.0001	10.4	0.001	1.00	0.016	0.11	0.68	7.61	X		
Barium	309SB05	Low	13.47	0.003	0.0350	0.0001	268	0.017	1.00	0.016	3.23	11.65	42.82	X		
Beryllium	309SB05	Low	0.01	0.003	0.0000	0.0001	0.48	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	309SB05	Low	0.09	0.003	0.0002	0.0001	1.55	0.000	1.00	0.016	0.02	0.07	3.12	X		
Chromium	309SB05	Low	2.72	0.003	0.0071	0.0001	32.5	0.002	1.00	0.016	0.57	7.09	28.42	X		
Copper	309SB05	Low	13.04	0.003	0.034	0.0001	49	0.00	1.00	0.016	2.31	3.12	704.00	X		
Lead	309SB05	Low	2.72	0.003	0.0071	0.0001	162	0.01	1.00	0.016	1.07	0.003	250.22		X	

APPENDIX I2

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Mercury	309SB05	Low	0.03	0.003	0.00007	0.0001	0.26	0.00002	1.00	0.016	0.01	0.29	4.87	X		
Molybdenum	309SB05	Low	2.15	0.003	0.0056	0.0001	0.47	0.000	1.00	0.016	0.35	0.30	3.04		X	
Selenium	309SB05	Low	0.07	0.003	0.000	0.0001	0.15	0.0000	1.00	0.016	0.01	0.06	1.35	X		
Silver	309SB05	Low	0.08	0.003	0.0002	0.0001	0.563	0.000	1.00	0.016	0.02	0.00	0.00			
Zinc	309SB05	Low	40.69	0.003	0.11	0.0001	284	0.02	1.00	0.016	7.72	10.80	748.21	X		
Antimony	309SB106	High	0.20	0.004	0.00	0.0001	0.37	0.00	1.00	0.009	0.08	0.17	1.69	X		
Arsenic	309SB106	High	35.29	0.004	0.1235	0.0001	7.7	0.001	1.00	0.009	13.80	0.79	8.79			X
Barium	309SB106	High	33.33	0.004	0.1167	0.0001	175	0.015	1.00	0.009	14.60	13.45	49.44		X	
Beryllium	309SB106	High	0.03	0.004	0.0001	0.0001	0.4	0.000	1.00	0.009	0.02	0.00	0.00			
Cadmium	309SB106	High	0.52	0.004	0.0018	0.0001	0.31	0.000	1.00	0.009	0.21	0.08	3.61		X	
Chromium	309SB106	High	5.88	0.004	0.0206	0.0001	29.4	0.002	1.00	0.009	2.56	8.19	32.81	X		
Copper	309SB106	High	22.88	0.004	0.080	0.0001	21.7	0.00	1.00	0.009	9.10	3.61	812.91		X	
Lead	309SB106	High	1.90	0.004	0.0066	0.0001	268	0.02	1.00	0.009	3.24	0.003	288.93		X	
Mercury	309SB106	High	0.07	0.004	0.00023	0.0001	0.005	0.00000	1.00	0.009	0.03	0.30	5.04	X		
Molybdenum	309SB106	High	3.99	0.004	0.0140	0.0001	0.31	0.000	1.00	0.009	1.55	0.35	3.51		X	
Selenium	309SB106	High	0.32	0.004	0.001	0.0001	0.1	0.0000	1.00	0.009	0.13	0.06	1.56		X	
Silver	309SB106	High	0.14	0.004	0.0005	0.0001	0.131	0.000	1.00	0.009	0.05	0.00	0.00			
Zinc	309SB106	High	98.04	0.004	0.34	0.0001	71.2	0.01	1.00	0.009	38.79	12.47	863.96		X	
Antimony	309SB106	Low	0.20	0.003	0.00	0.0001	0.37	0.00	1.00	0.016	0.03	0.15	1.46	X		
Arsenic	309SB106	Low	35.29	0.003	0.0918	0.0001	7.7	0.000	1.00	0.016	5.77	0.68	7.61		X	
Barium	309SB106	Low	33.33	0.003	0.0867	0.0001	175	0.011	1.00	0.016	6.10	0.00	0.00			X
Beryllium	309SB106	Low	0.03	0.003	0.0001	0.0001	0.4	0.000	1.00	0.016	0.01	7.09	28.42			
Cadmium	309SB106	Low	0.52	0.003	0.0014	0.0001	0.31	0.000	1.00	0.016	0.09	0.00	250.22		X	
Chromium	309SB106	Low	5.88	0.003	0.0153	0.0001	29.4	0.002	1.00	0.016	1.07	0.30	3.04		X	
Copper	309SB106	Low	22.88	0.003	0.059	0.0001	21.7	0.00	1.00	0.016	3.80	0.00	0.00			X
Lead	309SB106	Low	1.90	0.003	0.0049	0.0001	268	0.02	1.00	0.016	1.35	0.003	273.42		X	
Mercury	309SB106	Low	0.07	0.003	0.00017	0.0001	0.005	0.00000	1.00	0.016	0.01	0.29	4.87	X		
Molybdenum	309SB106	Low	3.99	0.003	0.0104	0.0001	0.31	0.000	1.00	0.016	0.65	0.35	3.51		X	
Selenium	309SB106	Low	0.32	0.003	0.001	0.0001	0.1	0.0000	1.00	0.016	0.05	0.10	1.47	X		
Silver	309SB106	Low	0.14	0.003	0.0004	0.0001	0.131	0.000	1.00	0.016	0.02	NA	NA			
Zinc	309SB106	Low	98.04	0.003	0.25	0.0001	71.2	0.00	1.00	0.016	16.21	11.79	817.63		X	
Antimony	SB01	High	2.97	0.004	0.01	0.0001	5.6	0.00	1.00	0.009	1.21	0.17	1.69		X	
Arsenic	SB01	High	267.47	0.004	0.9362	0.0001	58.4	0.005	1.00	0.009	104.56	0.79	8.79			X
Barium	SB01	High	885.40	0.004	3.0989	0.0001	4660	0.391	1.00	0.009	387.82	13.45	49.44			X
Beryllium	SB01	High	0.13	0.004	0.0004	0.0001	0.6	0.000	1.00	0.009	0.05	0.00	0.00			
Cadmium	SB01	High	0.47	0.004	0.0017	0.0001	0.28	0.000	1.00	0.009	0.19	0.08	3.61		X	
Chromium	SB01	High	27.20	0.004	0.0952	0.0001	136	0.011	1.00	0.009	11.85	8.19	32.81		X	
Copper	SB01	High	638.40	0.004	2.234	0.0001	608	0.05	1.00	0.009	253.94	3.61	812.91		X	
Lead	SB01	High	51.20	0.004	0.1792	0.0001	2560	0.22	1.00	0.009	43.80	0.003	288.93		X	
Mercury	SB01	High	5.49	0.004	0.01921	0.0001	0.42	0.00004	1.00	0.009	2.14	0.30	5.04		X	
Molybdenum	SB01	High	124.74	0.004	0.4366	0.0001	9.7	0.001	1.00	0.009	48.60	0.35	3.51			X
Selenium	SB01	High	1.56	0.004	0.005	0.0001	0.42	0.0000	1.00	0.009	0.61	0.06	1.56		X	
Silver	SB01	High	5.67	0.004	0.0198	0.0001	5.4	0.000	1.00	0.009	2.26	0.00	0.00			
Zinc	SB01	High	5644.20	0.004	19.75	0.0001	4090	0.34	1.00	0.009	2233.14	12.47	863.96			X
Antimony	SB01	Low	2.97	0.003	0.01	0.0001	5.6	0.00	1.00	0.016	0.50	0.15	1.46		X	
Arsenic	SB01	Low	267.47	0.003	0.6954	0.0001	58.4	0.004	1.00	0.016	43.69	0.68	7.61			X
Barium	SB01	Low	885.40	0.003	2.3020	0.0001	4660	0.291	1.00	0.016	162.05	11.65	42.82			X

APPENDIX I2
SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Beryllium	SB01	Low	0.13	0.003	0.0003	0.0001	0.6	0.000	1.00	0.016	0.02	0.00	0.00			
Cadmium	SB01	Low	0.47	0.003	0.0012	0.0001	0.28	0.000	1.00	0.016	0.08	0.07	3.12		X	
Chromium	SB01	Low	27.20	0.003	0.0707	0.0001	136	0.008	1.00	0.016	4.95	7.09	28.42	X		
Copper	SB01	Low	638.40	0.003	1.660	0.0001	608	0.04	1.00	0.016	106.11	3.12	704.00		X	
Lead	SB01	Low	51.20	0.003	0.1331	0.0001	2560	0.16	1.00	0.016	18.30	0.003	250.22		X	
Mercury	SB01	Low	5.49	0.003	0.01427	0.0001	0.42	0.00003	1.00	0.016	0.89	0.29	4.87		X	
Molybdenum	SB01	Low	124.74	0.003	0.3243	0.0001	9.7	0.001	1.00	0.016	20.31	0.30	3.04			X
Selenium	SB01	Low	1.56	0.003	0.004	0.0001	0.42	0.0000	1.00	0.016	0.26	0.06	1.35		X	
Silver	SB01	Low	5.67	0.003	0.0147	0.0001	5.4	0.000	1.00	0.016	0.94	0.00	0.00			
Zinc	SB01	Low	5644.20	0.003	14.67	0.0001	4090	0.26	1.00	0.016	933.13	10.80	748.21			X
Antimony	SB02	High	0.42	0.004	0.00	0.0001	0.8	0.00	1.00	0.009	0.17	0.17	1.69		X	
Arsenic	SB02	High	26.56	0.004	0.0930	0.0001	5.8	0.000	1.00	0.009	10.38	0.79	8.79			X
Barium	SB02	High	42.37	0.004	0.1483	0.0001	223	0.019	1.00	0.009	18.56	13.45	49.44		X	
Beryllium	SB02	High	0.07	0.004	0.0002	0.0001	0.31	0.000	1.00	0.009	0.03	0.00	0.00			
Cadmium	SB02	High	0.04	0.004	0.0001	0.0001	0.025	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB02	High	4.24	0.004	0.0148	0.0001	21.2	0.002	1.00	0.009	1.85	8.19	32.81	X		
Copper	SB02	High	26.99	0.004	0.094	0.0001	25.7	0.00	1.00	0.009	10.73	3.61	812.91		X	
Lead	SB02	High	0.69	0.004	0.0024	0.0001	34.7	0.00	1.00	0.009	0.59	0.003	288.93		X	
Mercury	SB02	High	0.39	0.004	0.00137	0.0001	0.03	0.00000	1.00	0.009	0.15	0.30	5.04	X		
Molybdenum	SB02	High	0.96	0.004	0.0034	0.0001	0.075	0.000	1.00	0.009	0.38	0.35	3.51		X	
Selenium	SB02	High	1.10	0.004	0.004	0.0001	0.295	0.0000	1.00	0.009	0.43	0.06	1.56		X	
Silver	SB02	High	0.07	0.004	0.0002	0.0001	0.065	0.000	1.00	0.009	0.03	0.00	0.00			
Zinc	SB02	High	123.51	0.004	0.43	0.0001	89.5	0.01	1.00	0.009	48.87	12.47	863.96		X	
Antimony	SB02	Low	0.42	0.003	0.00	0.0001	0.8	0.00	1.00	0.016	0.07	0.15	1.46	X		
Arsenic	SB02	Low	26.56	0.003	0.0691	0.0001	5.8	0.000	1.00	0.016	4.34	0.68	7.61		X	
Barium	SB02	Low	42.37	0.003	0.1102	0.0001	223	0.014	1.00	0.016	7.75	11.65	42.82	X		
Beryllium	SB02	Low	0.07	0.003	0.0002	0.0001	0.31	0.000	1.00	0.016	0.01	0.00	0.00			
Cadmium	SB02	Low	0.04	0.003	0.0001	0.0001	0.025	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB02	Low	4.24	0.003	0.0110	0.0001	21.2	0.001	1.00	0.016	0.77	7.09	28.42	X		
Copper	SB02	Low	26.99	0.003	0.070	0.0001	25.7	0.00	1.00	0.016	4.49	3.12	704.00		X	
Lead	SB02	Low	0.69	0.003	0.0018	0.0001	34.7	0.00	1.00	0.016	0.25	0.003	250.22		X	
Mercury	SB02	Low	0.39	0.003	0.00102	0.0001	0.03	0.00000	1.00	0.016	0.06	0.29	4.87	X		
Molybdenum	SB02	Low	0.96	0.003	0.0025	0.0001	0.075	0.000	1.00	0.016	0.16	0.30	3.04	X		
Selenium	SB02	Low	1.10	0.003	0.003	0.0001	0.295	0.0000	1.00	0.016	0.18	0.06	1.35		X	
Silver	SB02	Low	0.07	0.003	0.0002	0.0001	0.065	0.000	1.00	0.016	0.01	0.00	0.00			
Zinc	SB02	Low	123.51	0.003	0.32	0.0001	89.5	0.01	1.00	0.016	20.42	10.80	748.21		X	
Antimony	SB03	High	44.63	0.004	0.16	0.0001	84.2	0.01	1.00	0.009	18.14	0.17	1.69			X
Arsenic	SB03	High	650.36	0.004	2.2763	0.0001	142	0.012	1.00	0.009	254.24	0.79	8.79			X
Barium	SB03	High	145.35	0.004	0.5087	0.0001	765	0.064	1.00	0.009	63.67	13.45	49.44			X
Beryllium	SB03	High	0.07	0.004	0.0002	0.0001	0.33	0.000	1.00	0.009	0.03	0.00	0.00			
Cadmium	SB03	High	9.30	0.004	0.0325	0.0001	5.5	0.000	1.00	0.009	3.67	0.08	3.61			X
Chromium	SB03	High	25.00	0.004	0.0875	0.0001	125	0.011	1.00	0.009	10.89	8.19	32.81		X	
Copper	SB03	High	7003.50	0.004	24.512	0.0001	6670	0.56	1.00	0.009	2785.84	3.61	812.91			X
Lead	SB03	High	153.60	0.004	0.5376	0.0001	7680	0.65	1.00	0.009	131.41	0.003	288.93		X	
Mercury	SB03	High	345.05	0.004	1.20767	0.0001	26.4	0.00222	1.00	0.009	134.43	0.30	5.04			X
Molybdenum	SB03	High	232.77	0.004	0.8147	0.0001	18.1	0.002	1.00	0.009	90.69	0.35	3.51			X
Selenium	SB03	High	1.12	0.004	0.004	0.0001	0.3	0.0000	1.00	0.009	0.44	0.06	1.56		X	

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Silver	SB03	High	2.42	0.004	0.0085	0.0001	2.3	0.000	1.00	0.009	0.96	0.00	0.00			
Zinc	SB03	High	5464.80	0.004	19.13	0.0001	3960	0.33	1.00	0.009	2162.16	12.47	863.96			X
Antimony	SB03	Low	44.63	0.003	0.12	0.0001	84.2	0.01	1.00	0.016	7.58	0.15	1.46			X
Arsenic	SB03	Low	650.36	0.003	1.6909	0.0001	142	0.009	1.00	0.016	106.24	0.68	7.61			X
Barium	SB03	Low	145.35	0.003	0.3779	0.0001	765	0.048	1.00	0.016	26.60	11.65	42.82		X	
Beryllium	SB03	Low	0.07	0.003	0.0002	0.0001	0.33	0.000	1.00	0.016	0.01	0.00	0.00			
Cadmium	SB03	Low	9.30	0.003	0.0242	0.0001	5.5	0.000	1.00	0.016	1.53	0.07	3.12		X	
Chromium	SB03	Low	25.00	0.003	0.0650	0.0001	125	0.008	1.00	0.016	4.55	7.09	28.42	X		
Copper	SB03	Low	7003.50	0.003	18.209	0.0001	6670	0.42	1.00	0.016	1164.08	3.12	704.00			X
Lead	SB03	Low	153.60	0.003	0.3994	0.0001	7680	0.48	1.00	0.016	54.91	0.003	250.22		X	
Mercury	SB03	Low	345.05	0.003	0.89712	0.0001	26.4	0.00165	1.00	0.016	56.17	0.29	4.87			X
Molybdenum	SB03	Low	232.77	0.003	0.6052	0.0001	18.1	0.001	1.00	0.016	37.90	0.30	3.04			X
Selenium	SB03	Low	1.12	0.003	0.003	0.0001	0.3	0.0000	1.00	0.016	0.18	0.06	1.35		X	
Silver	SB03	Low	2.42	0.003	0.0063	0.0001	2.3	0.000	1.00	0.016	0.40	0.00	0.00			
Zinc	SB03	Low	5464.80	0.003	14.21	0.0001	3960	0.25	1.00	0.016	903.47	10.80	748.21			X
Antimony	SB04	High	9.59	0.004	0.03	0.0001	18.1	0.00	1.00	0.009	3.90	0.17	1.69			X
Arsenic	SB04	High	280.30	0.004	0.9810	0.0001	61.2	0.005	1.00	0.009	109.58	0.79	8.79			X
Barium	SB04	High	176.13	0.004	0.6165	0.0001	927	0.078	1.00	0.009	77.15	13.45	49.44			X
Beryllium	SB04	High	0.12	0.004	0.0004	0.0001	0.55	0.000	1.00	0.009	0.05	0.00	0.00			
Cadmium	SB04	High	4.73	0.004	0.0166	0.0001	2.8	0.000	1.00	0.009	1.87	0.08	3.61		X	
Chromium	SB04	High	23.80	0.004	0.0833	0.0001	119	0.010	1.00	0.009	10.37	8.19	32.81		X	
Copper	SB04	High	396.90	0.004	1.389	0.0001	378	0.03	1.00	0.009	157.88	3.61	812.91		X	
Lead	SB04	High	100.60	0.004	0.3521	0.0001	5030	0.42	1.00	0.009	86.07	0.003	288.93		X	
Mercury	SB04	High	27.45	0.004	0.09606	0.0001	2.1	0.00018	1.00	0.009	10.69	0.30	5.04			X
Molybdenum	SB04	High	77.16	0.004	0.2701	0.0001	6	0.001	1.00	0.009	30.06	0.35	3.51			X
Selenium	SB04	High	33.48	0.004	0.117	0.0001	9	0.0008	1.00	0.009	13.10	0.06	1.56			X
Silver	SB04	High	1.00	0.004	0.0035	0.0001	0.95	0.000	1.00	0.009	0.40	0.00	0.00			
Zinc	SB04	High	2898.00	0.004	10.14	0.0001	2100	0.18	1.00	0.009	1146.60	12.47	863.96			X
Antimony	SB04	Low	9.59	0.003	0.02	0.0001	18.1	0.00	1.00	0.016	1.63	0.15	1.46			X
Arsenic	SB04	Low	280.30	0.003	0.7288	0.0001	61.2	0.004	1.00	0.016	45.79	0.68	7.61			X
Barium	SB04	Low	176.13	0.003	0.4579	0.0001	927	0.058	1.00	0.016	32.24	11.65	42.82		X	
Beryllium	SB04	Low	0.12	0.003	0.0003	0.0001	0.55	0.000	1.00	0.016	0.02	0.00	0.00			
Cadmium	SB04	Low	4.73	0.003	0.0123	0.0001	2.8	0.000	1.00	0.016	0.78	0.07	3.12		X	
Chromium	SB04	Low	23.80	0.003	0.0619	0.0001	119	0.007	1.00	0.016	4.33	7.09	28.42	X		
Copper	SB04	Low	396.90	0.003	1.032	0.0001	378	0.02	1.00	0.016	65.97	3.12	704.00		X	
Lead	SB04	Low	100.60	0.003	0.2616	0.0001	5030	0.31	1.00	0.016	35.96	0.003	250.22		X	
Mercury	SB04	Low	27.45	0.003	0.07136	0.0001	2.1	0.00013	1.00	0.016	4.47	0.29	4.87		X	
Molybdenum	SB04	Low	77.16	0.003	0.2006	0.0001	6	0.000	1.00	0.016	12.56	0.30	3.04			X
Selenium	SB04	Low	33.48	0.003	0.087	0.0001	9	0.0006	1.00	0.016	5.48	0.06	1.35			X
Silver	SB04	Low	1.00	0.003	0.0026	0.0001	0.95	0.000	1.00	0.016	0.17	0.00	0.00			
Zinc	SB04	Low	2898.00	0.003	7.53	0.0001	2100	0.13	1.00	0.016	479.12	10.80	748.21		X	
Antimony	SB05	High	0.09	0.004	0.00	0.0001	0.17	0.00	1.00	0.009	0.04	0.17	1.69	X		
Arsenic	SB05	High	39.39	0.004	0.1379	0.0001	8.6	0.001	1.00	0.009	15.40	0.79	8.79			X
Barium	SB05	High	46.36	0.004	0.1623	0.0001	244	0.020	1.00	0.009	20.31	13.45	49.44		X	
Beryllium	SB05	High	0.09	0.004	0.0003	0.0001	0.43	0.000	1.00	0.009	0.04	0.00	0.00			
Cadmium	SB05	High	0.06	0.004	0.0002	0.0001	0.035	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB05	High	3.66	0.004	0.0128	0.0001	18.3	0.002	1.00	0.009	1.59	8.19	32.81	X		

APPENDIX I2

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Copper	SB05	High	29.82	0.004	0.104	0.0001	28.4	0.00	1.00	0.009	11.86	3.61	812.91		X	
Lead	SB05	High	4.02	0.004	0.0141	0.0001	201	0.02	1.00	0.009	3.44	0.003	288.93		X	
Mercury	SB05	High	0.46	0.004	0.00160	0.0001	0.035	0.00000	1.00	0.009	0.18	0.30	5.04	X		
Molybdenum	SB05	High	4.69	0.004	0.0164	0.0001	0.365	0.000	1.00	0.009	1.83	0.35	3.51		X	
Selenium	SB05	High	3.53	0.004	0.012	0.0001	0.95	0.0001	1.00	0.009	1.38	0.06	1.56		X	
Silver	SB05	High	0.89	0.004	0.0031	0.0001	0.85	0.000	1.00	0.009	0.36	0.00	0.00			
Zinc	SB05	High	173.88	0.004	0.61	0.0001	126	0.01	1.00	0.009	68.80	12.47	863.96		X	
Antimony	SB05	Low	0.09	0.003	0.00	0.0001	0.17	0.00	1.00	0.016	0.02	0.15	1.46	X		
Arsenic	SB05	Low	39.39	0.003	0.1024	0.0001	8.6	0.001	1.00	0.016	6.43	0.68	7.61		X	
Barium	SB05	Low	46.36	0.003	0.1205	0.0001	244	0.015	1.00	0.016	8.49	11.65	42.82	X		
Beryllium	SB05	Low	0.09	0.003	0.0002	0.0001	0.43	0.000	1.00	0.016	0.02	0.00	0.00			
Cadmium	SB05	Low	0.06	0.003	0.0002	0.0001	0.035	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB05	Low	3.66	0.003	0.0095	0.0001	18.3	0.001	1.00	0.016	0.67	7.09	28.42	X		
Copper	SB05	Low	29.82	0.003	0.078	0.0001	28.4	0.00	1.00	0.016	4.96	3.12	704.00		X	
Lead	SB05	Low	4.02	0.003	0.0105	0.0001	201	0.01	1.00	0.016	1.44	0.003	250.22		X	
Mercury	SB05	Low	0.46	0.003	0.00119	0.0001	0.035	0.00000	1.00	0.016	0.07	0.29	4.87	X		
Molybdenum	SB05	Low	4.69	0.003	0.0122	0.0001	0.365	0.000	1.00	0.016	0.76	0.30	3.04		X	
Selenium	SB05	Low	3.53	0.003	0.009	0.0001	0.95	0.0001	1.00	0.016	0.58	0.06	1.35		X	
Silver	SB05	Low	0.89	0.003	0.0023	0.0001	0.85	0.000	1.00	0.016	0.15	0.00	0.00			
Zinc	SB05	Low	173.88	0.003	0.45	0.0001	126	0.01	1.00	0.016	28.75	10.80	748.21		X	
Antimony	SB06	High	0.08	0.004	0.00	0.0001	0.16	0.00	1.00	0.009	0.03	0.17	1.69	X		
Arsenic	SB06	High	28.40	0.004	0.0994	0.0001	6.2	0.001	1.00	0.009	11.10	0.79	8.79			X
Barium	SB06	High	68.97	0.004	0.2414	0.0001	363	0.030	1.00	0.009	30.21	13.45	49.44		X	
Beryllium	SB06	High	0.12	0.004	0.0004	0.0001	0.57	0.000	1.00	0.009	0.05	0.00	0.00			
Cadmium	SB06	High	0.05	0.004	0.0002	0.0001	0.03	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB06	High	5.28	0.004	0.0185	0.0001	26.4	0.002	1.00	0.009	2.30	8.19	32.81	X		
Copper	SB06	High	21.11	0.004	0.074	0.0001	20.1	0.00	1.00	0.009	8.40	3.61	812.91		X	
Lead	SB06	High	1.34	0.004	0.0047	0.0001	66.9	0.01	1.00	0.009	1.14	0.003	288.93		X	
Mercury	SB06	High	0.33	0.004	0.00114	0.0001	0.025	0.00000	1.00	0.009	0.13	0.30	5.04	X		
Molybdenum	SB06	High	4.12	0.004	0.0144	0.0001	0.32	0.000	1.00	0.009	1.60	0.35	3.51		X	
Selenium	SB06	High	3.24	0.004	0.011	0.0001	0.87	0.0001	1.00	0.009	1.27	0.06	1.56		X	
Silver	SB06	High	0.79	0.004	0.0028	0.0001	0.75	0.000	1.00	0.009	0.31	0.00	0.00			
Zinc	SB06	High	58.10	0.004	0.20	0.0001	42.1	0.00	1.00	0.009	22.99	12.47	863.96		X	
Antimony	SB06	Low	0.08	0.003	0.00	0.0001	0.16	0.00	1.00	0.016	0.01	0.15	1.46	X		
Arsenic	SB06	Low	28.40	0.003	0.0738	0.0001	6.2	0.000	1.00	0.016	4.64	0.68	7.61		X	
Barium	SB06	Low	68.97	0.003	0.1793	0.0001	363	0.023	1.00	0.016	12.62	11.65	42.82		X	
Beryllium	SB06	Low	0.12	0.003	0.0003	0.0001	0.57	0.000	1.00	0.016	0.02	0.00	0.00			
Cadmium	SB06	Low	0.05	0.003	0.0001	0.0001	0.03	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB06	Low	5.28	0.003	0.0137	0.0001	26.4	0.002	1.00	0.016	0.96	7.09	28.42	X		
Copper	SB06	Low	21.11	0.003	0.055	0.0001	20.1	0.00	1.00	0.016	3.51	3.12	704.00		X	
Lead	SB06	Low	1.34	0.003	0.0035	0.0001	66.9	0.00	1.00	0.016	0.48	0.003	250.22		X	
Mercury	SB06	Low	0.33	0.003	0.00085	0.0001	0.025	0.00000	1.00	0.016	0.05	0.29	4.87	X		
Molybdenum	SB06	Low	4.12	0.003	0.0107	0.0001	0.32	0.000	1.00	0.016	0.67	0.30	3.04		X	
Selenium	SB06	Low	3.24	0.003	0.008	0.0001	0.87	0.0001	1.00	0.016	0.53	0.06	1.35		X	
Silver	SB06	Low	0.79	0.003	0.0020	0.0001	0.75	0.000	1.00	0.016	0.13	0.00	0.00			
Zinc	SB06	Low	58.10	0.003	0.15	0.0001	42.1	0.00	1.00	0.016	9.61	10.80	748.21	X		
Antimony	SB07	High	0.09	0.004	0.00	0.0001	0.175	0.00	1.00	0.009	0.04	0.17	1.69	X		

APPENDIX I2

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Arsenic	SB07	High	27.94	0.004	0.0978	0.0001	6.1	0.001	1.00	0.009	10.92	0.79	8.79			X
Barium	SB07	High	38.19	0.004	0.1337	0.0001	201	0.017	1.00	0.009	16.73	13.45	49.44		X	
Beryllium	SB07	High	0.11	0.004	0.0004	0.0001	0.5	0.000	1.00	0.009	0.05	0.00	0.00			
Cadmium	SB07	High	0.06	0.004	0.0002	0.0001	0.035	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB07	High	4.24	0.004	0.0148	0.0001	21.2	0.002	1.00	0.009	1.85	8.19	32.81	X		
Copper	SB07	High	32.03	0.004	0.112	0.0001	30.5	0.00	1.00	0.009	12.74	3.61	812.91		X	
Lead	SB07	High	3.68	0.004	0.0129	0.0001	184	0.02	1.00	0.009	3.15	0.003	288.93		X	
Mercury	SB07	High	0.39	0.004	0.00137	0.0001	0.03	0.00000	1.00	0.009	0.15	0.30	5.04	X		
Molybdenum	SB07	High	4.50	0.004	0.0158	0.0001	0.35	0.000	1.00	0.009	1.75	0.35	3.51		X	
Selenium	SB07	High	3.57	0.004	0.012	0.0001	0.96	0.0001	1.00	0.009	1.40	0.06	1.56		X	
Silver	SB07	High	0.84	0.004	0.0029	0.0001	0.8	0.000	1.00	0.009	0.33	0.00	0.00			
Zinc	SB07	High	165.60	0.004	0.58	0.0001	120	0.01	1.00	0.009	65.52	12.47	863.96		X	
Antimony	SB07	Low	0.09	0.003	0.00	0.0001	0.175	0.00	1.00	0.016	0.02	0.15	1.46	X		
Arsenic	SB07	Low	27.94	0.003	0.0726	0.0001	6.1	0.000	1.00	0.016	4.56	0.68	7.61		X	
Barium	SB07	Low	38.19	0.003	0.0993	0.0001	201	0.013	1.00	0.016	6.99	11.65	42.82	X		
Beryllium	SB07	Low	0.11	0.003	0.0003	0.0001	0.5	0.000	1.00	0.016	0.02	0.00	0.00			
Cadmium	SB07	Low	0.06	0.003	0.0002	0.0001	0.035	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB07	Low	4.24	0.003	0.0110	0.0001	21.2	0.001	1.00	0.016	0.77	7.09	28.42	X		
Copper	SB07	Low	32.03	0.003	0.083	0.0001	30.5	0.00	1.00	0.016	5.32	3.12	704.00		X	
Lead	SB07	Low	3.68	0.003	0.0096	0.0001	184	0.01	1.00	0.016	1.32	0.003	250.22		X	
Mercury	SB07	Low	0.39	0.003	0.00102	0.0001	0.03	0.00000	1.00	0.016	0.06	0.29	4.87	X		
Molybdenum	SB07	Low	4.50	0.003	0.0117	0.0001	0.35	0.000	1.00	0.016	0.73	0.30	3.04		X	
Selenium	SB07	Low	3.57	0.003	0.009	0.0001	0.96	0.0001	1.00	0.016	0.58	0.06	1.35		X	
Silver	SB07	Low	0.84	0.003	0.0022	0.0001	0.8	0.000	1.00	0.016	0.14	0.00	0.00			
Zinc	SB07	Low	165.60	0.003	0.43	0.0001	120	0.01	1.00	0.016	27.38	10.80	748.21		X	
Antimony	SB08	High	0.09	0.004	0.00	0.0001	0.17	0.00	1.00	0.009	0.04	0.17	1.69	X		
Arsenic	SB08	High	46.72	0.004	0.1635	0.0001	10.2	0.001	1.00	0.009	18.26	0.79	8.79			X
Barium	SB08	High	57.38	0.004	0.2008	0.0001	302	0.025	1.00	0.009	25.13	13.45	49.44		X	
Beryllium	SB08	High	0.12	0.004	0.0004	0.0001	0.58	0.000	1.00	0.009	0.05	0.00	0.00			
Cadmium	SB08	High	0.06	0.004	0.0002	0.0001	0.035	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB08	High	6.08	0.004	0.0213	0.0001	30.4	0.003	1.00	0.009	2.65	8.19	32.81	X		
Copper	SB08	High	41.06	0.004	0.144	0.0001	39.1	0.00	1.00	0.009	16.33	3.61	812.91		X	
Lead	SB08	High	2.58	0.004	0.0090	0.0001	129	0.01	1.00	0.009	2.21	0.003	288.93		X	
Mercury	SB08	High	0.39	0.004	0.00137	0.0001	0.03	0.00000	1.00	0.009	0.15	0.30	5.04	X		
Molybdenum	SB08	High	10.80	0.004	0.0378	0.0001	0.84	0.000	1.00	0.009	4.21	0.35	3.51			X
Selenium	SB08	High	1.43	0.004	0.005	0.0001	0.385	0.0000	1.00	0.009	0.56	0.06	1.56		X	
Silver	SB08	High	0.84	0.004	0.0029	0.0001	0.8	0.000	1.00	0.009	0.33	0.00	0.00			
Zinc	SB08	High	136.48	0.004	0.48	0.0001	98.9	0.01	1.00	0.009	54.00	12.47	863.96		X	
Antimony	SB08	Low	0.09	0.003	0.00	0.0001	0.17	0.00	1.00	0.016	0.02	0.15	1.46	X		
Arsenic	SB08	Low	46.72	0.003	0.1215	0.0001	10.2	0.001	1.00	0.016	7.63	0.68	7.61			X
Barium	SB08	Low	57.38	0.003	0.1492	0.0001	302	0.019	1.00	0.016	10.50	11.65	42.82	X		
Beryllium	SB08	Low	0.12	0.003	0.0003	0.0001	0.58	0.000	1.00	0.016	0.02	0.00	0.00			
Cadmium	SB08	Low	0.06	0.003	0.0002	0.0001	0.035	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB08	Low	6.08	0.003	0.0158	0.0001	30.4	0.002	1.00	0.016	1.11	7.09	28.42	X		
Copper	SB08	Low	41.06	0.003	0.107	0.0001	39.1	0.00	1.00	0.016	6.82	3.12	704.00		X	
Lead	SB08	Low	2.58	0.003	0.0067	0.0001	129	0.01	1.00	0.016	0.92	0.003	250.22		X	
Mercury	SB08	Low	0.39	0.003	0.00102	0.0001	0.03	0.00000	1.00	0.016	0.06	0.29	4.87	X		

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Molybdenum	SB08	Low	10.80	0.003	0.0281	0.0001	0.84	0.000	1.00	0.016	1.76	0.30	3.04		X	
Selenium	SB08	Low	1.43	0.003	0.004	0.0001	0.385	0.0000	1.00	0.016	0.23	0.06	1.35		X	
Silver	SB08	Low	0.84	0.003	0.0022	0.0001	0.8	0.000	1.00	0.016	0.14	0.00	0.00			
Zinc	SB08	Low	136.48	0.003	0.35	0.0001	98.9	0.01	1.00	0.016	22.56	10.80	748.21		X	
Antimony	SB09	High	3.18	0.004	0.01	0.0001	6	0.00	1.00	0.009	1.29	0.17	1.69		X	
Arsenic	SB09	High	173.12	0.004	0.6059	0.0001	37.8	0.003	1.00	0.009	67.68	0.79	8.79			X
Barium	SB09	High	74.29	0.004	0.2600	0.0001	391	0.033	1.00	0.009	32.54	13.45	49.44		X	
Beryllium	SB09	High	0.09	0.004	0.0003	0.0001	0.41	0.000	1.00	0.009	0.04	0.00	0.00			
Cadmium	SB09	High	5.58	0.004	0.0195	0.0001	3.3	0.000	1.00	0.009	2.20	0.08	3.61		X	
Chromium	SB09	High	8.62	0.004	0.0302	0.0001	43.1	0.004	1.00	0.009	3.75	8.19	32.81	X		
Copper	SB09	High	343.35	0.004	1.202	0.0001	327	0.03	1.00	0.009	136.58	3.61	812.91		X	
Lead	SB09	High	31.20	0.004	0.1092	0.0001	1560	0.13	1.00	0.009	26.69	0.003	288.93		X	
Mercury	SB09	High	28.75	0.004	0.10064	0.0001	2.2	0.00018	1.00	0.009	11.20	0.30	5.04			X
Molybdenum	SB09	High	27.01	0.004	0.0945	0.0001	2.1	0.000	1.00	0.009	10.52	0.35	3.51			X
Selenium	SB09	High	18.60	0.004	0.065	0.0001	5	0.0004	1.00	0.009	7.28	0.06	1.56			X
Silver	SB09	High	1.26	0.004	0.0044	0.0001	1.2	0.000	1.00	0.009	0.50	0.00	0.00			
Zinc	SB09	High	7465.80	0.004	26.13	0.0001	5410	0.45	1.00	0.009	2953.86	12.47	863.96			X
Antimony	SB09	Low	3.18	0.003	0.01	0.0001	6	0.00	1.00	0.016	0.54	0.15	1.46		X	
Arsenic	SB09	Low	173.12	0.003	0.4501	0.0001	37.8	0.002	1.00	0.016	28.28	0.68	7.61			X
Barium	SB09	Low	74.29	0.003	0.1932	0.0001	391	0.024	1.00	0.016	13.60	11.65	42.82		X	
Beryllium	SB09	Low	0.09	0.003	0.0002	0.0001	0.41	0.000	1.00	0.016	0.02	0.00	0.00			
Cadmium	SB09	Low	5.58	0.003	0.0145	0.0001	3.3	0.000	1.00	0.016	0.92	0.07	3.12		X	
Chromium	SB09	Low	8.62	0.003	0.0224	0.0001	43.1	0.003	1.00	0.016	1.57	7.09	28.42	X		
Copper	SB09	Low	343.35	0.003	0.893	0.0001	327	0.02	1.00	0.016	57.07	3.12	704.00		X	
Lead	SB09	Low	31.20	0.003	0.0811	0.0001	1560	0.10	1.00	0.016	11.15	0.003	250.22		X	
Mercury	SB09	Low	28.75	0.003	0.07476	0.0001	2.2	0.00014	1.00	0.016	4.68	0.29	4.87		X	
Molybdenum	SB09	Low	27.01	0.003	0.0702	0.0001	2.1	0.000	1.00	0.016	4.40	0.30	3.04			X
Selenium	SB09	Low	18.60	0.003	0.048	0.0001	5	0.0003	1.00	0.016	3.04	0.06	1.35			X
Silver	SB09	Low	1.26	0.003	0.0033	0.0001	1.2	0.000	1.00	0.016	0.21	0.00	0.00			
Zinc	SB09	Low	7465.80	0.003	19.41	0.0001	5410	0.34	1.00	0.016	1234.29	10.80	748.21			X
Antimony	SB10	High	17.07	0.004	0.06	0.0001	32.2	0.00	1.00	0.009	6.94	0.17	1.69			X
Arsenic	SB10	High	155.72	0.004	0.5450	0.0001	34	0.003	1.00	0.009	60.88	0.79	8.79			X
Barium	SB10	High	57.38	0.004	0.2008	0.0001	302	0.025	1.00	0.009	25.13	13.45	49.44		X	
Beryllium	SB10	High	0.09	0.004	0.0003	0.0001	0.41	0.000	1.00	0.009	0.04	0.00	0.00			
Cadmium	SB10	High	22.65	0.004	0.0793	0.0001	13.4	0.001	1.00	0.009	8.93	0.08	3.61			X
Chromium	SB10	High	20.00	0.004	0.0700	0.0001	100	0.008	1.00	0.009	8.71	8.19	32.81		X	
Copper	SB10	High	13125.00	0.004	45.938	0.0001	12500	1.05	1.00	0.009	5220.83	3.61	812.91			X
Lead	SB10	High	37.40	0.004	0.1309	0.0001	1870	0.16	1.00	0.009	32.00	0.003	288.93		X	
Mercury	SB10	High	9.02	0.004	0.03156	0.0001	0.69	0.00006	1.00	0.009	3.51	0.30	5.04		X	
Molybdenum	SB10	High	32.15	0.004	0.1125	0.0001	2.5	0.000	1.00	0.009	12.53	0.35	3.51			X
Selenium	SB10	High	14.88	0.004	0.052	0.0001	4	0.0003	1.00	0.009	5.82	0.06	1.56			X
Silver	SB10	High	0.89	0.004	0.0031	0.0001	0.85	0.000	1.00	0.009	0.36	0.00	0.00			
Zinc	SB10	High	6844.80	0.004	23.96	0.0001	4960	0.42	1.00	0.009	2708.16	12.47	863.96			X
Antimony	SB10	Low	17.07	0.003	0.04	0.0001	32.2	0.00	1.00	0.016	2.90	0.15	1.46			X
Arsenic	SB10	Low	155.72	0.003	0.4049	0.0001	34	0.002	1.00	0.016	25.44	0.68	7.61			X
Barium	SB10	Low	57.38	0.003	0.1492	0.0001	302	0.019	1.00	0.016	10.50	11.65	42.82	X		
Beryllium	SB10	Low	0.09	0.003	0.0002	0.0001	0.41	0.000	1.00	0.016	0.02	0.00	0.00			

APPENDIX I2
SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Cadmium	SB10	Low	22.65	0.003	0.0589	0.0001	13.4	0.001	1.00	0.016	3.73	0.07	3.12			X
Chromium	SB10	Low	20.00	0.003	0.0520	0.0001	100	0.006	1.00	0.016	3.64	7.09	28.42	X		
Copper	SB10	Low	13125.00	0.003	34.125	0.0001	12500	0.78	1.00	0.016	2181.56	3.12	704.00			X
Lead	SB10	Low	37.40	0.003	0.0972	0.0001	1870	0.12	1.00	0.016	13.37	0.003	250.22		X	
Mercury	SB10	Low	9.02	0.003	0.02345	0.0001	0.69	0.00004	1.00	0.016	1.47	0.29	4.87		X	
Molybdenum	SB10	Low	32.15	0.003	0.0836	0.0001	2.5	0.000	1.00	0.016	5.23	0.30	3.04			X
Selenium	SB10	Low	14.88	0.003	0.039	0.0001	4	0.0002	1.00	0.016	2.43	0.06	1.35			X
Silver	SB10	Low	0.89	0.003	0.0023	0.0001	0.85	0.000	1.00	0.016	0.15	0.00	0.00			
Zinc	SB10	Low	6844.80	0.003	17.80	0.0001	4960	0.31	1.00	0.016	1131.62	10.80	748.21			X
Antimony	SB105	High	0.24	0.004	0.00	0.0001	0.46	0.00	1.00	0.009	0.10	0.17	1.69	X		
Arsenic	SB105	High	2.18	0.004	0.0076	0.0001	0.475	0.000	1.00	0.009	0.85	0.79	8.79		X	
Barium	SB105	High	38.95	0.004	0.1363	0.0001	205	0.017	1.00	0.009	17.06	13.45	49.44		X	
Beryllium	SB105	High	0.00	0.004	0.0000	0.0001	0.013	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SB105	High	0.07	0.004	0.0002	0.0001	0.0395	0.000	1.00	0.009	0.03	0.08	3.61	X		
Chromium	SB105	High	2.96	0.004	0.0104	0.0001	14.8	0.001	1.00	0.009	1.29	8.19	32.81	X		
Copper	SB105	High	38.96	0.004	0.136	0.0001	37.1	0.00	1.00	0.009	15.50	3.61	812.91		X	
Lead	SB105	High	0.50	0.004	0.0017	0.0001	24.9	0.00	1.00	0.009	0.43	0.003	288.93		X	
Mercury	SB105	High	0.39	0.004	0.00137	0.0001	0.03	0.00000	1.00	0.009	0.15	0.30	5.04	X		
Molybdenum	SB105	High	2.57	0.004	0.0090	0.0001	0.2	0.000	1.00	0.009	1.00	0.35	3.51		X	
Selenium	SB105	High	2.23	0.004	0.008	0.0001	0.6	0.0001	1.00	0.009	0.87	0.06	1.56		X	
Silver	SB105	High	0.29	0.004	0.0010	0.0001	0.275	0.000	1.00	0.009	0.11	0.00	0.00			
Zinc	SB105	High	102.53	0.004	0.36	0.0001	74.3	0.01	1.00	0.009	40.57	12.47	863.96		X	
Antimony	SB105	Low	0.24	0.003	0.00	0.0001	0.46	0.00	1.00	0.016	0.04	0.15	1.46	X		
Arsenic	SB105	Low	2.18	0.003	0.0057	0.0001	0.475	0.000	1.00	0.016	0.36	0.68	7.61	X		
Barium	SB105	Low	38.95	0.003	0.1013	0.0001	205	0.013	1.00	0.016	7.13	11.65	42.82	X		
Beryllium	SB105	Low	0.00	0.003	0.0000	0.0001	0.013	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SB105	Low	0.07	0.003	0.0002	0.0001	0.0395	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB105	Low	2.96	0.003	0.0077	0.0001	14.8	0.001	1.00	0.016	0.54	7.09	28.42	X		
Copper	SB105	Low	38.96	0.003	0.101	0.0001	37.1	0.00	1.00	0.016	6.47	3.12	704.00		X	
Lead	SB105	Low	0.50	0.003	0.0013	0.0001	24.9	0.00	1.00	0.016	0.18	0.003	250.22		X	
Mercury	SB105	Low	0.39	0.003	0.00102	0.0001	0.03	0.00000	1.00	0.016	0.06	0.29	4.87	X		
Molybdenum	SB105	Low	2.57	0.003	0.0067	0.0001	0.2	0.000	1.00	0.016	0.42	0.30	3.04		X	
Selenium	SB105	Low	2.23	0.003	0.006	0.0001	0.6	0.0000	1.00	0.016	0.37	0.06	1.35		X	
Silver	SB105	Low	0.29	0.003	0.0008	0.0001	0.275	0.000	1.00	0.016	0.05	0.00	0.00			
Zinc	SB105	Low	102.53	0.003	0.27	0.0001	74.3	0.00	1.00	0.016	16.95	10.80	748.21		X	
Antimony	SB11	High	0.10	0.004	0.00	0.0001	0.19	0.00	1.00	0.009	0.04	0.17	1.69	X		
Arsenic	SB11	High	67.33	0.004	0.2356	0.0001	14.7	0.001	1.00	0.009	26.32	0.79	8.79			X
Barium	SB11	High	39.90	0.004	0.1397	0.0001	210	0.018	1.00	0.009	17.48	13.45	49.44		X	
Beryllium	SB11	High	0.09	0.004	0.0003	0.0001	0.45	0.000	1.00	0.009	0.04	0.00	0.00			
Cadmium	SB11	High	0.07	0.004	0.0002	0.0001	0.04	0.000	1.00	0.009	0.03	0.08	3.61	X		
Chromium	SB11	High	5.94	0.004	0.0208	0.0001	29.7	0.002	1.00	0.009	2.59	8.19	32.81	X		
Copper	SB11	High	52.71	0.004	0.184	0.0001	50.2	0.00	1.00	0.009	20.97	3.61	812.91		X	
Lead	SB11	High	6.36	0.004	0.0223	0.0001	318	0.03	1.00	0.009	5.44	0.003	288.93		X	
Mercury	SB11	High	0.39	0.004	0.00137	0.0001	0.03	0.00000	1.00	0.009	0.15	0.30	5.04	X		
Molybdenum	SB11	High	4.82	0.004	0.0169	0.0001	0.375	0.000	1.00	0.009	1.88	0.35	3.51		X	
Selenium	SB11	High	3.72	0.004	0.013	0.0001	1	0.0001	1.00	0.009	1.46	0.06	1.56		X	
Silver	SB11	High	0.95	0.004	0.0033	0.0001	0.9	0.000	1.00	0.009	0.38	0.00	0.00			

APPENDIX I2

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Zinc	SB11	High	212.52	0.004	0.74	0.0001	154	0.01	1.00	0.009	84.08	12.47	863.96		X	
Antimony	SB11	Low	0.10	0.003	0.00	0.0001	0.19	0.00	1.00	0.016	0.02	0.15	1.46	X		
Arsenic	SB11	Low	67.33	0.003	0.1750	0.0001	14.7	0.001	1.00	0.016	11.00	0.68	7.61			X
Barium	SB11	Low	39.90	0.003	0.1037	0.0001	210	0.013	1.00	0.016	7.30	11.65	42.82	X		
Beryllium	SB11	Low	0.09	0.003	0.0002	0.0001	0.45	0.000	1.00	0.016	0.02	0.00	0.00			
Cadmium	SB11	Low	0.07	0.003	0.0002	0.0001	0.04	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB11	Low	5.94	0.003	0.0154	0.0001	29.7	0.002	1.00	0.016	1.08	7.09	28.42	X		
Copper	SB11	Low	52.71	0.003	0.137	0.0001	50.2	0.00	1.00	0.016	8.76	3.12	704.00		X	
Lead	SB11	Low	6.36	0.003	0.0165	0.0001	318	0.02	1.00	0.016	2.27	0.003	250.22		X	
Mercury	SB11	Low	0.39	0.003	0.00102	0.0001	0.03	0.00000	1.00	0.016	0.06	0.29	4.87	X		
Molybdenum	SB11	Low	4.82	0.003	0.0125	0.0001	0.375	0.000	1.00	0.016	0.79	0.30	3.04		X	
Selenium	SB11	Low	3.72	0.003	0.010	0.0001	1	0.0001	1.00	0.016	0.61	0.06	1.35		X	
Silver	SB11	Low	0.95	0.003	0.0025	0.0001	0.9	0.000	1.00	0.016	0.16	0.00	0.00			
Zinc	SB11	Low	212.52	0.003	0.55	0.0001	154	0.01	1.00	0.016	35.14	10.80	748.21		X	
Antimony	SB12	High	2.65	0.004	0.01	0.0001	5	0.00	1.00	0.009	1.08	0.17	1.69		X	
Arsenic	SB12	High	30.23	0.004	0.1058	0.0001	6.6	0.001	1.00	0.009	11.82	0.79	8.79			X
Barium	SB12	High	76.76	0.004	0.2687	0.0001	404	0.034	1.00	0.009	33.62	13.45	49.44		X	
Beryllium	SB12	High	0.11	0.004	0.0004	0.0001	0.52	0.000	1.00	0.009	0.05	0.00	0.00			
Cadmium	SB12	High	0.06	0.004	0.0002	0.0001	0.035	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB12	High	5.52	0.004	0.0193	0.0001	27.6	0.002	1.00	0.009	2.40	8.19	32.81	X		
Copper	SB12	High	75.29	0.004	0.263	0.0001	71.7	0.01	1.00	0.009	29.95	3.61	812.91		X	
Lead	SB12	High	14.98	0.004	0.0524	0.0001	749	0.06	1.00	0.009	12.82	0.003	288.93		X	
Mercury	SB12	High	0.39	0.004	0.00137	0.0001	0.03	0.00000	1.00	0.009	0.15	0.30	5.04	X		
Molybdenum	SB12	High	4.69	0.004	0.0164	0.0001	0.365	0.000	1.00	0.009	1.83	0.35	3.51		X	
Selenium	SB12	High	4.09	0.004	0.014	0.0001	1.1	0.0001	1.00	0.009	1.60	0.06	1.56			X
Silver	SB12	High	0.89	0.004	0.0031	0.0001	0.85	0.000	1.00	0.009	0.36	0.00	0.00			
Zinc	SB12	High	270.48	0.004	0.95	0.0001	196	0.02	1.00	0.009	107.02	12.47	863.96		X	
Antimony	SB12	Low	2.65	0.003	0.01	0.0001	5	0.00	1.00	0.016	0.45	0.15	1.46		X	
Arsenic	SB12	Low	30.23	0.003	0.0786	0.0001	6.6	0.000	1.00	0.016	4.94	0.68	7.61		X	
Barium	SB12	Low	76.76	0.003	0.1996	0.0001	404	0.025	1.00	0.016	14.05	11.65	42.82		X	
Beryllium	SB12	Low	0.11	0.003	0.0003	0.0001	0.52	0.000	1.00	0.016	0.02	0.00	0.00			
Cadmium	SB12	Low	0.06	0.003	0.0002	0.0001	0.035	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB12	Low	5.52	0.003	0.0144	0.0001	27.6	0.002	1.00	0.016	1.00	7.09	28.42	X		
Copper	SB12	Low	75.29	0.003	0.196	0.0001	71.7	0.00	1.00	0.016	12.51	3.12	704.00		X	
Lead	SB12	Low	14.98	0.003	0.0389	0.0001	749	0.05	1.00	0.016	5.36	0.003	250.22		X	
Mercury	SB12	Low	0.39	0.003	0.00102	0.0001	0.03	0.00000	1.00	0.016	0.06	0.29	4.87	X		
Molybdenum	SB12	Low	4.69	0.003	0.0122	0.0001	0.365	0.000	1.00	0.016	0.76	0.30	3.04		X	
Selenium	SB12	Low	4.09	0.003	0.011	0.0001	1.1	0.0001	1.00	0.016	0.67	0.06	1.35		X	
Silver	SB12	Low	0.89	0.003	0.0023	0.0001	0.85	0.000	1.00	0.016	0.15	0.00	0.00			
Zinc	SB12	Low	270.48	0.003	0.70	0.0001	196	0.01	1.00	0.016	44.72	10.80	748.21		X	
Antimony	SB13	High	1.33	0.004	0.00	0.0001	2.5	0.00	1.00	0.009	0.54	0.17	1.69		X	
Arsenic	SB13	High	90.23	0.004	0.3158	0.0001	19.7	0.002	1.00	0.009	35.27	0.79	8.79			X
Barium	SB13	High	129.20	0.004	0.4522	0.0001	680	0.057	1.00	0.009	56.59	13.45	49.44			X
Beryllium	SB13	High	0.00	0.004	0.0000	0.0001	0.009	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SB13	High	0.06	0.004	0.0002	0.0001	0.0355	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB13	High	9.08	0.004	0.0318	0.0001	45.4	0.004	1.00	0.009	3.95	8.19	32.81	X		
Copper	SB13	High	1081.50	0.004	3.785	0.0001	1030	0.09	1.00	0.009	430.20	3.61	812.91		X	

APPENDIX I2
SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Lead	SB13	High	11.94	0.004	0.0418	0.0001	597	0.05	1.00	0.009	10.22	0.003	288.93		X	
Mercury	SB13	High	5.10	0.004	0.01784	0.0001	0.39	0.00003	1.00	0.009	1.99	0.30	5.04		X	
Molybdenum	SB13	High	3870.86	0.004	13.5480	0.0001	301	0.025	1.00	0.009	1508.14	0.35	3.51			X
Selenium	SB13	High	8.93	0.004	0.031	0.0001	2.4	0.0002	1.00	0.009	3.49	0.06	1.56			X
Silver	SB13	High	2.63	0.004	0.0092	0.0001	2.5	0.000	1.00	0.009	1.04	0.00	0.00			
Zinc	SB13	High	1258.56	0.004	4.40	0.0001	912	0.08	1.00	0.009	497.95	12.47	863.96		X	
Antimony	SB13	Low	1.33	0.003	0.00	0.0001	2.5	0.00	1.00	0.016	0.23	0.15	1.46		X	
Arsenic	SB13	Low	90.23	0.003	0.2346	0.0001	19.7	0.001	1.00	0.016	14.74	0.68	7.61			X
Barium	SB13	Low	129.20	0.003	0.3359	0.0001	680	0.042	1.00	0.016	23.65	11.65	42.82		X	
Beryllium	SB13	Low	0.00	0.003	0.0000	0.0001	0.009	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SB13	Low	0.06	0.003	0.0002	0.0001	0.0355	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB13	Low	9.08	0.003	0.0236	0.0001	45.4	0.003	1.00	0.016	1.65	7.09	28.42	X		
Copper	SB13	Low	1081.50	0.003	2.812	0.0001	1030	0.06	1.00	0.016	179.76	3.12	704.00		X	
Lead	SB13	Low	11.94	0.003	0.0310	0.0001	597	0.04	1.00	0.016	4.27	0.003	250.22		X	
Mercury	SB13	Low	5.10	0.003	0.01325	0.0001	0.39	0.00002	1.00	0.016	0.83	0.29	4.87		X	
Molybdenum	SB13	Low	3870.86	0.003	10.0642	0.0001	301	0.019	1.00	0.016	630.19	0.30	3.04			X
Selenium	SB13	Low	8.93	0.003	0.023	0.0001	2.4	0.0001	1.00	0.016	1.46	0.06	1.35			X
Silver	SB13	Low	2.63	0.003	0.0068	0.0001	2.5	0.000	1.00	0.016	0.44	0.00	0.00			
Zinc	SB13	Low	1258.56	0.003	3.27	0.0001	912	0.06	1.00	0.016	208.07	10.80	748.21		X	
Antimony	SB14	High	3.39	0.004	0.01	0.0001	6.4	0.00	1.00	0.009	1.38	0.17	1.69		X	
Arsenic	SB14	High	281.21	0.004	0.9842	0.0001	61.4	0.005	1.00	0.009	109.93	0.79	8.79			X
Barium	SB14	High	216.60	0.004	0.7581	0.0001	1140	0.096	1.00	0.009	94.87	13.45	49.44			X
Beryllium	SB14	High	0.00	0.004	0.0000	0.0001	0.009	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SB14	High	0.06	0.004	0.0002	0.0001	0.035	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB14	High	15.60	0.004	0.0546	0.0001	78	0.007	1.00	0.009	6.79	8.19	32.81	X		
Copper	SB14	High	283.50	0.004	0.992	0.0001	270	0.02	1.00	0.009	112.77	3.61	812.91		X	
Lead	SB14	High	65.60	0.004	0.2296	0.0001	3280	0.28	1.00	0.009	56.12	0.003	288.93		X	
Mercury	SB14	High	1.05	0.004	0.00366	0.0001	0.08	0.00001	1.00	0.009	0.41	0.30	5.04		X	
Molybdenum	SB14	High	64.30	0.004	0.2251	0.0001	5	0.000	1.00	0.009	25.05	0.35	3.51			X
Selenium	SB14	High	29.02	0.004	0.102	0.0001	7.8	0.0007	1.00	0.009	11.36	0.06	1.56			X
Silver	SB14	High	2.73	0.004	0.0096	0.0001	2.6	0.000	1.00	0.009	1.09	0.00	0.00			
Zinc	SB14	High	2290.80	0.004	8.02	0.0001	1660	0.14	1.00	0.009	906.36	12.47	863.96			X
Antimony	SB14	Low	3.39	0.003	0.01	0.0001	6.4	0.00	1.00	0.016	0.58	0.15	1.46		X	
Arsenic	SB14	Low	281.21	0.003	0.7312	0.0001	61.4	0.004	1.00	0.016	45.94	0.68	7.61			X
Barium	SB14	Low	216.60	0.003	0.5632	0.0001	1140	0.071	1.00	0.016	39.64	11.65	42.82		X	
Beryllium	SB14	Low	0.00	0.003	0.0000	0.0001	0.009	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SB14	Low	0.06	0.003	0.0002	0.0001	0.035	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB14	Low	15.60	0.003	0.0406	0.0001	78	0.005	1.00	0.016	2.84	7.09	28.42	X		
Copper	SB14	Low	283.50	0.003	0.737	0.0001	270	0.02	1.00	0.016	47.12	3.12	704.00		X	
Lead	SB14	Low	65.60	0.003	0.1706	0.0001	3280	0.20	1.00	0.016	23.45	0.003	250.22		X	
Mercury	SB14	Low	1.05	0.003	0.00272	0.0001	0.08	0.00000	1.00	0.016	0.17	0.29	4.87	X		
Molybdenum	SB14	Low	64.30	0.003	0.1672	0.0001	5	0.000	1.00	0.016	10.47	0.30	3.04			X
Selenium	SB14	Low	29.02	0.003	0.075	0.0001	7.8	0.0005	1.00	0.016	4.75	0.06	1.35			X
Silver	SB14	Low	2.73	0.003	0.0071	0.0001	2.6	0.000	1.00	0.016	0.45	0.00	0.00			
Zinc	SB14	Low	2290.80	0.003	5.96	0.0001	1660	0.10	1.00	0.016	378.73	10.80	748.21		X	
Antimony	SB15	High	13.94	0.004	0.05	0.0001	26.3	0.00	1.00	0.009	5.67	0.17	1.69			X
Arsenic	SB15	High	264.27	0.004	0.9249	0.0001	57.7	0.005	1.00	0.009	103.31	0.79	8.79			X

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APPENDIX I2
SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Barium	SB15	High	129.77	0.004	0.4542	0.0001	683	0.057	1.00	0.009	56.84	13.45	49.44			X
Beryllium	SB15	High	0.00	0.004	0.0000	0.0001	0.016	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SB15	High	0.11	0.004	0.0004	0.0001	0.065	0.000	1.00	0.009	0.04	0.08	3.61	X		
Chromium	SB15	High	598.00	0.004	2.0930	0.0001	2990	0.251	1.00	0.009	260.46	8.19	32.81			X
Copper	SB15	High	762.30	0.004	2.668	0.0001	726	0.06	1.00	0.009	303.23	3.61	812.91		X	
Lead	SB15	High	20.40	0.004	0.0714	0.0001	1020	0.09	1.00	0.009	17.45	0.003	288.93		X	
Mercury	SB15	High	2.03	0.004	0.00709	0.0001	0.155	0.00001	1.00	0.009	0.79	0.30	5.04		X	
Molybdenum	SB15	High	99.02	0.004	0.3466	0.0001	7.7	0.001	1.00	0.009	38.58	0.35	3.51			X
Selenium	SB15	High	25.30	0.004	0.089	0.0001	6.8	0.0006	1.00	0.009	9.90	0.06	1.56			X
Silver	SB15	High	2.94	0.004	0.0103	0.0001	2.8	0.000	1.00	0.009	1.17	0.00	0.00			
Zinc	SB15	High	2125.20	0.004	7.44	0.0001	1540	0.13	1.00	0.009	840.84	12.47	863.96		X	
Antimony	SB15	Low	13.94	0.003	0.04	0.0001	26.3	0.00	1.00	0.016	2.37	0.15	1.46			X
Arsenic	SB15	Low	264.27	0.003	0.6871	0.0001	57.7	0.004	1.00	0.016	43.17	0.68	7.61			X
Barium	SB15	Low	129.77	0.003	0.3374	0.0001	683	0.043	1.00	0.016	23.75	11.65	42.82		X	
Beryllium	SB15	Low	0.00	0.003	0.0000	0.0001	0.016	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SB15	Low	0.11	0.003	0.0003	0.0001	0.065	0.000	1.00	0.016	0.02	0.07	3.12	X		
Chromium	SB15	Low	598.00	0.003	1.5548	0.0001	2990	0.187	1.00	0.016	108.84	7.09	28.42			X
Copper	SB15	Low	762.30	0.003	1.982	0.0001	726	0.05	1.00	0.016	126.71	3.12	704.00		X	
Lead	SB15	Low	20.40	0.003	0.0530	0.0001	1020	0.06	1.00	0.016	7.29	0.003	250.22		X	
Mercury	SB15	Low	2.03	0.003	0.00527	0.0001	0.155	0.00001	1.00	0.016	0.33	0.29	4.87		X	
Molybdenum	SB15	Low	99.02	0.003	0.2575	0.0001	7.7	0.000	1.00	0.016	16.12	0.30	3.04			X
Selenium	SB15	Low	25.30	0.003	0.066	0.0001	6.8	0.0004	1.00	0.016	4.14	0.06	1.35			X
Silver	SB15	Low	2.94	0.003	0.0076	0.0001	2.8	0.000	1.00	0.016	0.49	0.00	0.00			
Zinc	SB15	Low	2125.20	0.003	5.53	0.0001	1540	0.10	1.00	0.016	351.35	10.80	748.21		X	
Antimony	SB16	High	0.77	0.004	0.00	0.0001	1.45	0.00	1.00	0.009	0.31	0.17	1.69		X	
Arsenic	SB16	High	43.51	0.004	0.1523	0.0001	9.5	0.001	1.00	0.009	17.01	0.79	8.79			X
Barium	SB16	High	23.37	0.004	0.0818	0.0001	123	0.010	1.00	0.009	10.24	13.45	49.44	X		
Beryllium	SB16	High	0.01	0.004	0.0000	0.0001	0.0495	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SB16	High	0.34	0.004	0.0012	0.0001	0.2	0.000	1.00	0.009	0.13	0.08	3.61		X	
Chromium	SB16	High	0.18	0.004	0.0006	0.0001	0.89	0.000	1.00	0.009	0.08	8.19	32.81	X		
Copper	SB16	High	1.16	0.004	0.004	0.0001	1.1	0.00	1.00	0.009	0.46	3.61	812.91	X		
Lead	SB16	High	0.03	0.004	0.0001	0.0001	1.7	0.00	1.00	0.009	0.03	0.003	288.93		X	
Mercury	SB16	High	6.47	0.004	0.02264	0.0001	0.495	0.00004	1.00	0.009	2.52	0.30	5.04		X	
Molybdenum	SB16	High	15.43	0.004	0.0540	0.0001	1.2	0.000	1.00	0.009	6.01	0.35	3.51			X
Selenium	SB16	High	7.44	0.004	0.026	0.0001	2	0.0002	1.00	0.009	2.91	0.06	1.56			X
Silver	SB16	High	0.58	0.004	0.0020	0.0001	0.55	0.000	1.00	0.009	0.23	0.00	0.00			
Zinc	SB16	High	4.42	0.004	0.02	0.0001	3.2	0.00	1.00	0.009	1.75	12.47	863.96	X		
Antimony	SB16	Low	0.77	0.003	0.00	0.0001	1.45	0.00	1.00	0.016	0.13	0.15	1.46	X		
Arsenic	SB16	Low	43.51	0.003	0.1131	0.0001	9.5	0.001	1.00	0.016	7.11	0.68	7.61		X	
Barium	SB16	Low	23.37	0.003	0.0608	0.0001	123	0.008	1.00	0.016	4.28	11.65	42.82	X		
Beryllium	SB16	Low	0.01	0.003	0.0000	0.0001	0.0495	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SB16	Low	0.34	0.003	0.0009	0.0001	0.2	0.000	1.00	0.016	0.06	0.07	3.12	X		
Chromium	SB16	Low	0.18	0.003	0.0005	0.0001	0.89	0.000	1.00	0.016	0.03	7.09	28.42	X		
Copper	SB16	Low	1.16	0.003	0.003	0.0001	1.1	0.00	1.00	0.016	0.19	3.12	704.00	X		
Lead	SB16	Low	0.03	0.003	0.0001	0.0001	1.7	0.00	1.00	0.016	0.01	0.003	250.22		X	
Mercury	SB16	Low	6.47	0.003	0.01682	0.0001	0.495	0.00003	1.00	0.016	1.05	0.29	4.87		X	
Molybdenum	SB16	Low	15.43	0.003	0.0401	0.0001	1.2	0.000	1.00	0.016	2.51	0.30	3.04		X	

DS.0309.15133

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Selenium	SB16	Low	7.44	0.003	0.019	0.0001	2	0.0001	1.00	0.016	1.22	0.06	1.35		X	
Silver	SB16	Low	0.58	0.003	0.0015	0.0001	0.55	0.000	1.00	0.016	0.10	0.00	0.00			
Zinc	SB16	Low	4.42	0.003	0.01	0.0001	3.2	0.00	1.00	0.016	0.73	10.80	748.21	X		
Antimony	SB17	High	0.21	0.004	0.00	0.0001	0.39	0.00	1.00	0.009	0.08	0.17	1.69	X		
Arsenic	SB17	High	1.56	0.004	0.0055	0.0001	0.34	0.000	1.00	0.009	0.61	0.79	8.79	X		
Barium	SB17	High	1.06	0.004	0.0037	0.0001	5.6	0.000	1.00	0.009	0.47	13.45	49.44	X		
Beryllium	SB17	High	0.00	0.004	0.0000	0.0001	0.007	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SB17	High	0.05	0.004	0.0002	0.0001	0.027	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB17	High	34.80	0.004	0.1218	0.0001	174	0.015	1.00	0.009	15.16	8.19	32.81		X	
Copper	SB17	High	540.75	0.004	1.893	0.0001	515	0.04	1.00	0.009	215.10	3.61	812.91		X	
Lead	SB17	High	40.60	0.004	0.1421	0.0001	2030	0.17	1.00	0.009	34.74	0.003	288.93		X	
Mercury	SB17	High	0.91	0.004	0.00320	0.0001	0.07	0.00001	1.00	0.009	0.36	0.30	5.04		X	
Molybdenum	SB17	High	88.73	0.004	0.3106	0.0001	6.9	0.001	1.00	0.009	34.57	0.35	3.51			X
Selenium	SB17	High	44.64	0.004	0.156	0.0001	12	0.0010	1.00	0.009	17.47	0.06	1.56			X
Silver	SB17	High	0.08	0.004	0.0003	0.0001	0.075	0.000	1.00	0.009	0.03	0.00	0.00			
Zinc	SB17	High	2842.80	0.004	9.95	0.0001	2060	0.17	1.00	0.009	1124.76	12.47	863.96			X
Antimony	SB17	Low	0.21	0.003	0.00	0.0001	0.39	0.00	1.00	0.016	0.04	0.15	1.46	X		
Arsenic	SB17	Low	1.56	0.003	0.0040	0.0001	0.34	0.000	1.00	0.016	0.25	0.68	7.61	X		
Barium	SB17	Low	1.06	0.003	0.0028	0.0001	5.6	0.000	1.00	0.016	0.19	11.65	42.82	X		
Beryllium	SB17	Low	0.00	0.003	0.0000	0.0001	0.007	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SB17	Low	0.05	0.003	0.0001	0.0001	0.027	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB17	Low	34.80	0.003	0.0905	0.0001	174	0.011	1.00	0.016	6.33	7.09	28.42	X		
Copper	SB17	Low	540.75	0.003	1.406	0.0001	515	0.03	1.00	0.016	89.88	3.12	704.00		X	
Lead	SB17	Low	40.60	0.003	0.1056	0.0001	2030	0.13	1.00	0.016	14.51	0.003	250.22		X	
Mercury	SB17	Low	0.91	0.003	0.00238	0.0001	0.07	0.00000	1.00	0.016	0.15	0.29	4.87	X		
Molybdenum	SB17	Low	88.73	0.003	0.2307	0.0001	6.9	0.000	1.00	0.016	14.45	0.30	3.04			X
Selenium	SB17	Low	44.64	0.003	0.116	0.0001	12	0.0007	1.00	0.016	7.30	0.06	1.35			X
Silver	SB17	Low	0.08	0.003	0.0002	0.0001	0.075	0.000	1.00	0.016	0.01	0.00	0.00			
Zinc	SB17	Low	2842.80	0.003	7.39	0.0001	2060	0.13	1.00	0.016	469.99	10.80	748.21		X	
Antimony	SB18	High	3.07	0.004	0.01	0.0001	5.8	0.00	1.00	0.009	1.25	0.17	1.69		X	
Arsenic	SB18	High	485.48	0.004	1.6992	0.0001	106	0.009	1.00	0.009	189.79	0.79	8.79			X
Barium	SB18	High	36.86	0.004	0.1290	0.0001	194	0.016	1.00	0.009	16.15	13.45	49.44		X	
Beryllium	SB18	High	0.00	0.004	0.0000	0.0001	0.0115	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SB18	High	0.08	0.004	0.0003	0.0001	0.046	0.000	1.00	0.009	0.03	0.08	3.61	X		
Chromium	SB18	High	9.58	0.004	0.0335	0.0001	47.9	0.004	1.00	0.009	4.17	8.19	32.81	X		
Copper	SB18	High	1753.50	0.004	6.137	0.0001	1670	0.14	1.00	0.009	697.50	3.61	812.91		X	
Lead	SB18	High	25.40	0.004	0.0889	0.0001	1270	0.11	1.00	0.009	21.73	0.003	288.93		X	
Mercury	SB18	High	1.44	0.004	0.00503	0.0001	0.11	0.00001	1.00	0.009	0.56	0.30	5.04		X	
Molybdenum	SB18	High	84.88	0.004	0.2971	0.0001	6.6	0.001	1.00	0.009	33.07	0.35	3.51			X
Selenium	SB18	High	28.27	0.004	0.099	0.0001	7.6	0.0006	1.00	0.009	11.07	0.06	1.56			X
Silver	SB18	High	0.13	0.004	0.0005	0.0001	0.125	0.000	1.00	0.009	0.05	0.00	0.00			
Zinc	SB18	High	1559.40	0.004	5.46	0.0001	1130	0.09	1.00	0.009	616.98	12.47	863.96		X	
Antimony	SB18	Low	3.07	0.003	0.01	0.0001	5.8	0.00	1.00	0.016	0.52	0.15	1.46		X	
Arsenic	SB18	Low	485.48	0.003	1.2622	0.0001	106	0.007	1.00	0.016	79.30	0.68	7.61			X
Barium	SB18	Low	36.86	0.003	0.0958	0.0001	194	0.012	1.00	0.016	6.75	11.65	42.82	X		
Beryllium	SB18	Low	0.00	0.003	0.0000	0.0001	0.0115	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SB18	Low	0.08	0.003	0.0002	0.0001	0.046	0.000	1.00	0.016	0.01	0.07	3.12	X		

APPENDIX I2

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Chromium	SB18	Low	9.58	0.003	0.0249	0.0001	47.9	0.003	1.00	0.016	1.74	7.09	28.42	X		
Copper	SB18	Low	1753.50	0.003	4.559	0.0001	1670	0.10	1.00	0.016	291.46	3.12	704.00		X	
Lead	SB18	Low	25.40	0.003	0.0660	0.0001	1270	0.08	1.00	0.016	9.08	0.003	250.22		X	
Mercury	SB18	Low	1.44	0.003	0.00374	0.0001	0.11	0.00001	1.00	0.016	0.23	0.29	4.87	X		
Molybdenum	SB18	Low	84.88	0.003	0.2207	0.0001	6.6	0.000	1.00	0.016	13.82	0.30	3.04			X
Selenium	SB18	Low	28.27	0.003	0.074	0.0001	7.6	0.0005	1.00	0.016	4.62	0.06	1.35			X
Silver	SB18	Low	0.13	0.003	0.0003	0.0001	0.125	0.000	1.00	0.016	0.02	0.00	0.00			
Zinc	SB18	Low	1559.40	0.003	4.05	0.0001	1130	0.07	1.00	0.016	257.81	10.80	748.21		X	
Antimony	SB19	High	2.01	0.004	0.01	0.0001	3.8	0.00	1.00	0.009	0.82	0.17	1.69		X	
Arsenic	SB19	High	241.37	0.004	0.8448	0.0001	52.7	0.004	1.00	0.009	94.36	0.79	8.79			X
Barium	SB19	High	34.96	0.004	0.1224	0.0001	184	0.015	1.00	0.009	15.31	13.45	49.44		X	
Beryllium	SB19	High	0.00	0.004	0.0000	0.0001	0.008	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SB19	High	0.05	0.004	0.0002	0.0001	0.0325	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB19	High	17.00	0.004	0.0595	0.0001	85	0.007	1.00	0.009	7.40	8.19	32.81	X		
Copper	SB19	High	453.60	0.004	1.588	0.0001	432	0.04	1.00	0.009	180.43	3.61	812.91		X	
Lead	SB19	High	32.80	0.004	0.1148	0.0001	1640	0.14	1.00	0.009	28.06	0.003	288.93		X	
Mercury	SB19	High	1.11	0.004	0.00389	0.0001	0.085	0.00001	1.00	0.009	0.43	0.30	5.04		X	
Molybdenum	SB19	High	77.16	0.004	0.2701	0.0001	6	0.001	1.00	0.009	30.06	0.35	3.51			X
Selenium	SB19	High	42.78	0.004	0.150	0.0001	11.5	0.0010	1.00	0.009	16.74	0.06	1.56			X
Silver	SB19	High	0.09	0.004	0.0003	0.0001	0.09	0.000	1.00	0.009	0.04	0.00	0.00			
Zinc	SB19	High	1017.06	0.004	3.56	0.0001	737	0.06	1.00	0.009	402.40	12.47	863.96		X	
Antimony	SB19	Low	2.01	0.003	0.01	0.0001	3.8	0.00	1.00	0.016	0.34	0.15	1.46		X	
Arsenic	SB19	Low	241.37	0.003	0.6276	0.0001	52.7	0.003	1.00	0.016	39.43	0.68	7.61			X
Barium	SB19	Low	34.96	0.003	0.0909	0.0001	184	0.011	1.00	0.016	6.40	11.65	42.82	X		
Beryllium	SB19	Low	0.00	0.003	0.0000	0.0001	0.008	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SB19	Low	0.05	0.003	0.0001	0.0001	0.0325	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB19	Low	17.00	0.003	0.0442	0.0001	85	0.005	1.00	0.016	3.09	7.09	28.42	X		
Copper	SB19	Low	453.60	0.003	1.179	0.0001	432	0.03	1.00	0.016	75.39	3.12	704.00		X	
Lead	SB19	Low	32.80	0.003	0.0853	0.0001	1640	0.10	1.00	0.016	11.73	0.003	250.22		X	
Mercury	SB19	Low	1.11	0.003	0.00289	0.0001	0.085	0.00001	1.00	0.016	0.18	0.29	4.87	X		
Molybdenum	SB19	Low	77.16	0.003	0.2006	0.0001	6	0.000	1.00	0.016	12.56	0.30	3.04			X
Selenium	SB19	Low	42.78	0.003	0.111	0.0001	11.5	0.0007	1.00	0.016	7.00	0.06	1.35			X
Silver	SB19	Low	0.09	0.003	0.0002	0.0001	0.09	0.000	1.00	0.016	0.02	0.00	0.00			
Zinc	SB19	Low	1017.06	0.003	2.64	0.0001	737	0.05	1.00	0.016	168.15	10.80	748.21		X	
Antimony	SB20	High	1.43	0.004	0.01	0.0001	2.7	0.00	1.00	0.009	0.58	0.17	1.69		X	
Arsenic	SB20	High	104.88	0.004	0.3671	0.0001	22.9	0.002	1.00	0.009	41.00	0.79	8.79			X
Barium	SB20	High	63.84	0.004	0.2234	0.0001	336	0.028	1.00	0.009	27.96	13.45	49.44		X	
Beryllium	SB20	High	0.00	0.004	0.0000	0.0001	0.0075	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SB20	High	0.05	0.004	0.0002	0.0001	0.03	0.000	1.00	0.009	0.02	0.08	3.61	X		
Chromium	SB20	High	14.92	0.004	0.0522	0.0001	74.6	0.006	1.00	0.009	6.50	8.19	32.81	X		
Copper	SB20	High	2079.00	0.004	7.277	0.0001	1980	0.17	1.00	0.009	826.98	3.61	812.91			X
Lead	SB20	High	23.60	0.004	0.0826	0.0001	1180	0.10	1.00	0.009	20.19	0.003	288.93		X	
Mercury	SB20	High	8.36	0.004	0.02928	0.0001	0.64	0.00005	1.00	0.009	3.26	0.30	5.04		X	
Molybdenum	SB20	High	37.29	0.004	0.1305	0.0001	2.9	0.000	1.00	0.009	14.53	0.35	3.51			X
Selenium	SB20	High	15.62	0.004	0.055	0.0001	4.2	0.0004	1.00	0.009	6.12	0.06	1.56			X
Silver	SB20	High	0.09	0.004	0.0003	0.0001	0.085	0.000	1.00	0.009	0.04	0.00	0.00			
Zinc	SB20	High	2484.00	0.004	8.69	0.0001	1800	0.15	1.00	0.009	982.80	12.47	863.96			X

APPENDIX I2
SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Antimony	SB20	Low	1.43	0.003	0.00	0.0001	2.7	0.00	1.00	0.016	0.24	0.15	1.46		X	
Arsenic	SB20	Low	104.88	0.003	0.2727	0.0001	22.9	0.001	1.00	0.016	17.13	0.68	7.61			X
Barium	SB20	Low	63.84	0.003	0.1660	0.0001	336	0.021	1.00	0.016	11.68	11.65	42.82		X	
Beryllium	SB20	Low	0.00	0.003	0.0000	0.0001	0.0075	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SB20	Low	0.05	0.003	0.0001	0.0001	0.03	0.000	1.00	0.016	0.01	0.07	3.12	X		
Chromium	SB20	Low	14.92	0.003	0.0388	0.0001	74.6	0.005	1.00	0.016	2.72	7.09	28.42	X		
Copper	SB20	Low	2079.00	0.003	5.405	0.0001	1980	0.12	1.00	0.016	345.56	3.12	704.00		X	
Lead	SB20	Low	23.60	0.003	0.0614	0.0001	1180	0.07	1.00	0.016	8.44	0.003	250.22		X	
Mercury	SB20	Low	8.36	0.003	0.02175	0.0001	0.64	0.00004	1.00	0.016	1.36	0.29	4.87		X	
Molybdenum	SB20	Low	37.29	0.003	0.0970	0.0001	2.9	0.000	1.00	0.016	6.07	0.30	3.04			X
Selenium	SB20	Low	15.62	0.003	0.041	0.0001	4.2	0.0003	1.00	0.016	2.56	0.06	1.35			X
Silver	SB20	Low	0.09	0.003	0.0002	0.0001	0.085	0.000	1.00	0.016	0.01	0.00	0.00			
Zinc	SB20	Low	2484.00	0.003	6.46	0.0001	1800	0.11	1.00	0.016	410.67	10.80	748.21		X	
Antimony	SS206	High	0.64	0.004	0.00	0.0001	1.2	0.00	1.00	0.009	0.26	0.17	1.69		X	
Arsenic	SS206	High	35.27	0.004	0.1234	0.0001	7.7	0.001	1.00	0.009	13.79	0.79	8.79			X
Barium	SS206	High	40.85	0.004	0.1430	0.0001	215	0.018	1.00	0.009	17.89	13.45	49.44		X	
Beryllium	SS206	High	0.00	0.004	0.0000	0.0001	0.0033	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SS206	High	2.70	0.004	0.0095	0.0001	1.6	0.000	1.00	0.009	1.07	0.08	3.61		X	
Chromium	SS206	High	5.78	0.004	0.0202	0.0001	28.9	0.002	1.00	0.009	2.52	8.19	32.81	X		
Copper	SS206	High	593.25	0.004	2.076	0.0001	565	0.05	1.00	0.009	235.98	3.61	812.91		X	
Lead	SS206	High	9.72	0.004	0.0340	0.0001	486	0.04	1.00	0.009	8.32	0.003	288.93		X	
Mercury	SS206	High	0.33	0.004	0.00114	0.0001	0.025	0.00000	1.00	0.009	0.13	0.30	5.04	X		
Molybdenum	SS206	High	8.62	0.004	0.0302	0.0001	0.67	0.000	1.00	0.009	3.36	0.35	3.51		X	
Selenium	SS206	High	0.37	0.004	0.001	0.0001	0.1	0.0000	1.00	0.009	0.15	0.06	1.56		X	
Silver	SS206	High	7.04	0.004	0.0246	0.0001	6.7	0.001	1.00	0.009	2.80	0.00	0.00			
Zinc	SS206	High	1356.54	0.004	4.75	0.0001	983	0.08	1.00	0.009	536.72	12.47	863.96		X	
Antimony	SS206	Low	0.64	0.003	0.00	0.0001	1.2	0.00	1.00	0.016	0.11	0.15	1.46	X		
Arsenic	SS206	Low	35.27	0.003	0.0917	0.0001	7.7	0.000	1.00	0.016	5.76	0.68	7.61		X	
Barium	SS206	Low	40.85	0.003	0.1062	0.0001	215	0.013	1.00	0.016	7.48	11.65	42.82	X		
Beryllium	SS206	Low	0.00	0.003	0.0000	0.0001	0.0033	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SS206	Low	2.70	0.003	0.0070	0.0001	1.6	0.000	1.00	0.016	0.45	0.07	3.12		X	
Chromium	SS206	Low	5.78	0.003	0.0150	0.0001	28.9	0.002	1.00	0.016	1.05	7.09	28.42	X		
Copper	SS206	Low	593.25	0.003	1.542	0.0001	565	0.04	1.00	0.016	98.61	3.12	704.00		X	
Lead	SS206	Low	9.72	0.003	0.0253	0.0001	486	0.03	1.00	0.016	3.47	0.003	250.22		X	
Mercury	SS206	Low	0.33	0.003	0.00085	0.0001	0.025	0.00000	1.00	0.016	0.05	0.29	4.87	X		
Molybdenum	SS206	Low	8.62	0.003	0.0224	0.0001	0.67	0.000	1.00	0.016	1.40	0.30	3.04		X	
Selenium	SS206	Low	0.37	0.003	0.001	0.0001	0.1	0.0000	1.00	0.016	0.06	0.06	1.35		X	
Silver	SS206	Low	7.04	0.003	0.0183	0.0001	6.7	0.000	1.00	0.016	1.17	0.00	0.00			
Zinc	SS206	Low	1356.54	0.003	3.53	0.0001	983	0.06	1.00	0.016	224.27	10.80	748.21		X	
Antimony	SS210	High	NA	0.004	#VALUE!	0.0001	NA	#VALUE!	1.00	0.009	#VALUE!	0.17	1.69	#VALUE!	#VALUE!	#VALUE!
Arsenic	SS210	High	21.53	0.004	0.0753	0.0001	4.7	0.000	1.00	0.009	8.42	0.79	8.79		X	
Barium	SS210	High	20.90	0.004	0.0732	0.0001	110	0.009	1.00	0.009	9.15	13.45	49.44	X		
Beryllium	SS210	High	0.00	0.004	0.0000	0.0001	0.003	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SS210	High	0.64	0.004	0.0022	0.0001	0.38	0.000	1.00	0.009	0.25	0.08	3.61		X	
Chromium	SS210	High	4.66	0.004	0.0163	0.0001	23.3	0.002	1.00	0.009	2.03	8.19	32.81	X		
Copper	SS210	High	13.97	0.004	0.049	0.0001	13.3	0.00	1.00	0.009	5.55	3.61	812.91		X	
Lead	SS210	High	0.60	0.004	0.0021	0.0001	29.8	0.00	1.00	0.009	0.51	0.003	288.93		X	

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Mercury	SS210	High	0.33	0.004	0.00114	0.0001	0.025	0.00000	1.00	0.009	0.13	0.30	5.04	X		
Molybdenum	SS210	High	1.16	0.004	0.0041	0.0001	0.09	0.000	1.00	0.009	0.45	0.35	3.51		X	
Selenium	SS210	High	0.78	0.004	0.003	0.0001	0.21	0.0000	1.00	0.009	0.31	0.06	1.56		X	
Silver	SS210	High	0.04	0.004	0.0001	0.0001	0.037	0.000	1.00	0.009	0.02	0.00	0.00			
Zinc	SS210	High	97.15	0.004	0.34	0.0001	70.4	0.01	1.00	0.009	38.44	12.47	863.96		X	
Antimony	SS210	Low	NA	0.003	#VALUE!	0.0001	NA	#VALUE!	1.00	0.016	#VALUE!	0.15	1.46	#VALUE!	#VALUE!	#VALUE!
Arsenic	SS210	Low	21.53	0.003	0.0560	0.0001	4.7	0.000	1.00	0.016	3.52	0.68	7.61		X	
Barium	SS210	Low	20.90	0.003	0.0543	0.0001	110	0.007	1.00	0.016	3.83	11.65	42.82	X		
Beryllium	SS210	Low	0.00	0.003	0.0000	0.0001	0.003	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SS210	Low	0.64	0.003	0.0017	0.0001	0.38	0.000	1.00	0.016	0.11	0.07	3.12		X	
Chromium	SS210	Low	4.66	0.003	0.0121	0.0001	23.3	0.001	1.00	0.016	0.85	7.09	28.42	X		
Copper	SS210	Low	13.97	0.003	0.036	0.0001	13.3	0.00	1.00	0.016	2.32	3.12	704.00	X		
Lead	SS210	Low	0.60	0.003	0.0015	0.0001	29.8	0.00	1.00	0.016	0.21	0.003	250.22		X	
Mercury	SS210	Low	0.33	0.003	0.00085	0.0001	0.025	0.00000	1.00	0.016	0.05	0.29	4.87	X		
Molybdenum	SS210	Low	1.16	0.003	0.0030	0.0001	0.09	0.000	1.00	0.016	0.19	0.30	3.04	X		
Selenium	SS210	Low	0.78	0.003	0.002	0.0001	0.21	0.0000	1.00	0.016	0.13	0.06	1.35		X	
Silver	SS210	Low	0.04	0.003	0.0001	0.0001	0.037	0.000	1.00	0.016	0.01	0.00	0.00			
Zinc	SS210	Low	97.15	0.003	0.25	0.0001	70.4	0.00	1.00	0.016	16.06	10.80	748.21		X	
Antimony	SS211	High	NA	0.004	#VALUE!	0.0001	NA	#VALUE!	1.00	0.009	#VALUE!	0.17	1.69	#VALUE!	#VALUE!	#VALUE!
Arsenic	SS211	High	14.20	0.004	0.0497	0.0001	3.1	0.000	1.00	0.009	5.55	0.79	8.79		X	
Barium	SS211	High	23.75	0.004	0.0831	0.0001	125	0.011	1.00	0.009	10.40	13.45	49.44	X		
Beryllium	SS211	High	0.00	0.004	0.0000	0.0001	0.003	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SS211	High	0.01	0.004	0.0001	0.0001	0.0085	0.000	1.00	0.009	0.01	0.08	3.61	X		
Chromium	SS211	High	3.28	0.004	0.0115	0.0001	16.4	0.001	1.00	0.009	1.43	8.19	32.81	X		
Copper	SS211	High	9.66	0.004	0.034	0.0001	9.2	0.00	1.00	0.009	3.84	3.61	812.91		X	
Lead	SS211	High	0.89	0.004	0.0031	0.0001	44.5	0.00	1.00	0.009	0.76	0.003	288.93		X	
Mercury	SS211	High	0.26	0.004	0.00091	0.0001	0.02	0.00000	1.00	0.009	0.10	0.30	5.04	X		
Molybdenum	SS211	High	1.16	0.004	0.0041	0.0001	0.09	0.000	1.00	0.009	0.45	0.35	3.51		X	
Selenium	SS211	High	0.33	0.004	0.001	0.0001	0.09	0.0000	1.00	0.009	0.13	0.06	1.56		X	
Silver	SS211	High	0.04	0.004	0.0001	0.0001	0.037	0.000	1.00	0.009	0.02	0.00	0.00			
Zinc	SS211	High	64.17	0.004	0.22	0.0001	46.5	0.00	1.00	0.009	25.39	12.47	863.96		X	
Antimony	SS211	Low	NA	0.003	#VALUE!	0.0001	NA	#VALUE!	1.00	0.016	#VALUE!	0.15	1.46	#VALUE!	#VALUE!	#VALUE!
Arsenic	SS211	Low	14.20	0.003	0.0369	0.0001	3.1	0.000	1.00	0.016	2.32	0.68	7.61		X	
Barium	SS211	Low	23.75	0.003	0.0618	0.0001	125	0.008	1.00	0.016	4.35	11.65	42.82	X		
Beryllium	SS211	Low	0.00	0.003	0.0000	0.0001	0.003	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SS211	Low	0.01	0.003	0.0000	0.0001	0.0085	0.000	1.00	0.016	0.00	0.07	3.12	X		
Chromium	SS211	Low	3.28	0.003	0.0085	0.0001	16.4	0.001	1.00	0.016	0.60	7.09	28.42	X		
Copper	SS211	Low	9.66	0.003	0.025	0.0001	9.2	0.00	1.00	0.016	1.61	3.12	704.00	X		
Lead	SS211	Low	0.89	0.003	0.0023	0.0001	44.5	0.00	1.00	0.016	0.32	0.003	250.22		X	
Mercury	SS211	Low	0.26	0.003	0.00068	0.0001	0.02	0.00000	1.00	0.016	0.04	0.29	4.87	X		
Molybdenum	SS211	Low	1.16	0.003	0.0030	0.0001	0.09	0.000	1.00	0.016	0.19	0.30	3.04	X		
Selenium	SS211	Low	0.33	0.003	0.001	0.0001	0.09	0.0000	1.00	0.016	0.05	0.06	1.35	X		
Silver	SS211	Low	0.04	0.003	0.0001	0.0001	0.037	0.000	1.00	0.016	0.01	0.00	0.00			
Zinc	SS211	Low	64.17	0.003	0.17	0.0001	46.5	0.00	1.00	0.016	10.61	10.80	748.21	X		
Antimony	SS212	High	0.32	0.004	0.00	0.0001	0.6	0.00	1.00	0.009	0.13	0.17	1.69	X		
Arsenic	SS212	High	14.20	0.004	0.0497	0.0001	3.1	0.000	1.00	0.009	5.55	0.79	8.79		X	
Barium	SS212	High	17.33	0.004	0.0606	0.0001	91.2	0.008	1.00	0.009	7.59	13.45	49.44	X		

APPENDIX I2
SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Beryllium	SS212	High	0.00	0.004	0.0000	0.0001	0.01	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SS212	High	0.61	0.004	0.0021	0.0001	0.36	0.000	1.00	0.009	0.24	0.08	3.61		X	
Chromium	SS212	High	6.24	0.004	0.0218	0.0001	31.2	0.003	1.00	0.009	2.72	8.19	32.81	X		
Copper	SS212	High	20.58	0.004	0.072	0.0001	19.6	0.00	1.00	0.009	8.19	3.61	812.91		X	
Lead	SS212	High	1.13	0.004	0.0039	0.0001	56.3	0.00	1.00	0.009	0.96	0.003	288.93		X	
Mercury	SS212	High	0.33	0.004	0.00114	0.0001	0.025	0.00000	1.00	0.009	0.13	0.30	5.04	X		
Molybdenum	SS212	High	1.03	0.004	0.0036	0.0001	0.08	0.000	1.00	0.009	0.40	0.35	3.51		X	
Selenium	SS212	High	0.32	0.004	0.001	0.0001	0.085	0.0000	1.00	0.009	0.12	0.06	1.56		X	
Silver	SS212	High	0.04	0.004	0.0001	0.0001	0.035	0.000	1.00	0.009	0.01	0.00	0.00			
Zinc	SS212	High	143.52	0.004	0.50	0.0001	104	0.01	1.00	0.009	56.78	12.47	863.96		X	
Antimony	SS212	Low	0.32	0.003	0.00	0.0001	0.6	0.00	1.00	0.016	0.05	0.15	1.46	X		
Arsenic	SS212	Low	14.20	0.003	0.0369	0.0001	3.1	0.000	1.00	0.016	2.32	0.68	7.61		X	
Barium	SS212	Low	17.33	0.003	0.0451	0.0001	91.2	0.006	1.00	0.016	3.17	11.65	42.82	X		
Beryllium	SS212	Low	0.00	0.003	0.0000	0.0001	0.01	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SS212	Low	0.61	0.003	0.0016	0.0001	0.36	0.000	1.00	0.016	0.10	0.07	3.12		X	
Chromium	SS212	Low	6.24	0.003	0.0162	0.0001	31.2	0.002	1.00	0.016	1.14	7.09	28.42	X		
Copper	SS212	Low	20.58	0.003	0.054	0.0001	19.6	0.00	1.00	0.016	3.42	3.12	704.00		X	
Lead	SS212	Low	1.13	0.003	0.0029	0.0001	56.3	0.00	1.00	0.016	0.40	0.003	250.22		X	
Mercury	SS212	Low	0.33	0.003	0.00085	0.0001	0.025	0.00000	1.00	0.016	0.05	0.29	4.87	X		
Molybdenum	SS212	Low	1.03	0.003	0.0027	0.0001	0.08	0.000	1.00	0.016	0.17	0.30	3.04	X		
Selenium	SS212	Low	0.32	0.003	0.001	0.0001	0.085	0.0000	1.00	0.016	0.05	0.06	1.35	X		
Silver	SS212	Low	0.04	0.003	0.0001	0.0001	0.035	0.000	1.00	0.016	0.01	0.00	0.00			
Zinc	SS212	Low	143.52	0.003	0.37	0.0001	104	0.01	1.00	0.016	23.73	10.80	748.21		X	
Antimony	SS213	High	NA	0.004	#VALUE!	0.0001	NA	#VALUE!	1.00	0.009	#VALUE!	0.17	1.69	#VALUE!	#VALUE!	#VALUE!
Arsenic	SS213	High	33.89	0.004	0.1186	0.0001	7.4	0.001	1.00	0.009	13.25	0.79	8.79			X
Barium	SS213	High	22.42	0.004	0.0785	0.0001	118	0.010	1.00	0.009	9.82	13.45	49.44	X		
Beryllium	SS213	High	0.00	0.004	0.0000	0.0001	0.0025	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SS213	High	1.17	0.004	0.0041	0.0001	0.69	0.000	1.00	0.009	0.46	0.08	3.61		X	
Chromium	SS213	High	4.82	0.004	0.0169	0.0001	24.1	0.002	1.00	0.009	2.10	8.19	32.81	X		
Copper	SS213	High	59.96	0.004	0.210	0.0001	57.1	0.00	1.00	0.009	23.85	3.61	812.91		X	
Lead	SS213	High	2.20	0.004	0.0077	0.0001	110	0.01	1.00	0.009	1.88	0.003	288.93		X	
Mercury	SS213	High	3.27	0.004	0.01144	0.0001	0.25	0.00002	1.00	0.009	1.27	0.30	5.04		X	
Molybdenum	SS213	High	1.03	0.004	0.0036	0.0001	0.08	0.000	1.00	0.009	0.40	0.35	3.51		X	
Selenium	SS213	High	0.32	0.004	0.001	0.0001	0.085	0.0000	1.00	0.009	0.12	0.06	1.56		X	
Silver	SS213	High	0.04	0.004	0.0001	0.0001	0.035	0.000	1.00	0.009	0.01	0.00	0.00			
Zinc	SS213	High	465.06	0.004	1.63	0.0001	337	0.03	1.00	0.009	184.00	12.47	863.96		X	
Antimony	SS213	Low	NA	0.003	#VALUE!	0.0001	NA	#VALUE!	1.00	0.016	#VALUE!	0.15	1.46	#VALUE!	#VALUE!	#VALUE!
Arsenic	SS213	Low	33.89	0.003	0.0881	0.0001	7.4	0.000	1.00	0.016	5.54	0.68	7.61		X	
Barium	SS213	Low	22.42	0.003	0.0583	0.0001	118	0.007	1.00	0.016	4.10	11.65	42.82	X		
Beryllium	SS213	Low	0.00	0.003	0.0000	0.0001	0.0025	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SS213	Low	1.17	0.003	0.0030	0.0001	0.69	0.000	1.00	0.016	0.19	0.07	3.12		X	
Chromium	SS213	Low	4.82	0.003	0.0125	0.0001	24.1	0.002	1.00	0.016	0.88	7.09	28.42	X		
Copper	SS213	Low	59.96	0.003	0.156	0.0001	57.1	0.00	1.00	0.016	9.97	3.12	704.00		X	
Lead	SS213	Low	2.20	0.003	0.0057	0.0001	110	0.01	1.00	0.016	0.79	0.003	250.22		X	
Mercury	SS213	Low	3.27	0.003	0.00850	0.0001	0.25	0.00002	1.00	0.016	0.53	0.29	4.87		X	
Molybdenum	SS213	Low	1.03	0.003	0.0027	0.0001	0.08	0.000	1.00	0.016	0.17	0.30	3.04	X		
Selenium	SS213	Low	0.32	0.003	0.001	0.0001	0.085	0.0000	1.00	0.016	0.05	0.06	1.35	X		

APPENDIX I2
SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Silver	SS213	Low	0.04	0.003	0.0001	0.0001	0.035	0.000	1.00	0.016	0.01	0.00	0.00			
Zinc	SS213	Low	465.06	0.003	1.21	0.0001	337	0.02	1.00	0.016	76.89	10.80	748.21		X	
Antimony	SS214	High	0.23	0.004	0.00	0.0001	0.44	0.00	1.00	0.009	0.09	0.17	1.69	X		
Arsenic	SS214	High	37.10	0.004	0.1298	0.0001	8.1	0.001	1.00	0.009	14.50	0.79	8.79			X
Barium	SS214	High	16.76	0.004	0.0587	0.0001	88.2	0.007	1.00	0.009	7.34	13.45	49.44	X		
Beryllium	SS214	High	0.00	0.004	0.0000	0.0001	0.0025	0.000	1.00	0.009	0.00	0.00	0.00			
Cadmium	SS214	High	0.64	0.004	0.0022	0.0001	0.38	0.000	1.00	0.009	0.25	0.08	3.61		X	
Chromium	SS214	High	4.80	0.004	0.0168	0.0001	24	0.002	1.00	0.009	2.09	8.19	32.81	X		
Copper	SS214	High	18.38	0.004	0.064	0.0001	17.5	0.00	1.00	0.009	7.31	3.61	812.91		X	
Lead	SS214	High	3.90	0.004	0.0137	0.0001	195	0.02	1.00	0.009	3.34	0.003	288.93		X	
Mercury	SS214	High	0.36	0.004	0.00126	0.0001	0.0275	0.00000	1.00	0.009	0.14	0.30	5.04	X		
Molybdenum	SS214	High	1.29	0.004	0.0045	0.0001	0.1	0.000	1.00	0.009	0.50	0.35	3.51		X	
Selenium	SS214	High	0.63	0.004	0.002	0.0001	0.17	0.0000	1.00	0.009	0.25	0.06	1.56		X	
Silver	SS214	High	0.03	0.004	0.0001	0.0001	0.033	0.000	1.00	0.009	0.01	0.00	0.00			
Zinc	SS214	High	109.02	0.004	0.38	0.0001	79	0.01	1.00	0.009	43.13	12.47	863.96		X	
Antimony	SS214	Low	0.23	0.003	0.00	0.0001	0.44	0.00	1.00	0.016	0.04	0.15	1.46	X		
Arsenic	SS214	Low	37.10	0.003	0.0965	0.0001	8.1	0.001	1.00	0.016	6.06	0.68	7.61		X	
Barium	SS214	Low	16.76	0.003	0.0436	0.0001	88.2	0.006	1.00	0.016	3.07	11.65	42.82	X		
Beryllium	SS214	Low	0.00	0.003	0.0000	0.0001	0.0025	0.000	1.00	0.016	0.00	0.00	0.00			
Cadmium	SS214	Low	0.64	0.003	0.0017	0.0001	0.38	0.000	1.00	0.016	0.11	0.07	3.12		X	
Chromium	SS214	Low	4.80	0.003	0.0125	0.0001	24	0.001	1.00	0.016	0.87	7.09	28.42	X		
Copper	SS214	Low	18.38	0.003	0.048	0.0001	17.5	0.00	1.00	0.016	3.05	3.12	704.00	X		
Lead	SS214	Low	3.90	0.003	0.0101	0.0001	195	0.01	1.00	0.016	1.39	0.003	250.22		X	
Mercury	SS214	Low	0.36	0.003	0.00093	0.0001	0.0275	0.00000	1.00	0.016	0.06	0.29	4.87	X		
Molybdenum	SS214	Low	1.29	0.003	0.0033	0.0001	0.1	0.000	1.00	0.016	0.21	0.30	3.04	X		
Selenium	SS214	Low	0.63	0.003	0.002	0.0001	0.17	0.0000	1.00	0.016	0.10	0.06	1.35		X	
Silver	SS214	Low	0.03	0.003	0.0001	0.0001	0.033	0.000	1.00	0.016	0.01	0.00	0.00			
Zinc	SS214	Low	109.02	0.003	0.28	0.0001	79	0.00	1.00	0.016	18.02	10.80	748.21		X	
Antimony	UCL 95	High	0.54	0.004	0.00	0.0001	13.2	0.00	1.00	0.009	0.33	0.17	1.69		X	
Arsenic	UCL 95	High	35.29	0.004	0.1235	0.0001	37.6	0.003	1.00	0.009	14.08	0.79	8.79			X
Barium	UCL 95	High	39.64	0.004	0.1387	0.0001	716	0.060	1.00	0.009	22.10	13.45	49.44		X	
Beryllium	UCL 95	High	0.05	0.004	0.0002	0.0001	0.3	0.000	1.00	0.009	0.02	0.00	0.00			
Cadmium	UCL 95	High	3.24	0.004	0.0114	0.0001	2.1	0.000	1.00	0.009	1.28	0.08	3.61		X	
Chromium	UCL 95	High	7.12	0.004	0.0249	0.0001	308	0.026	1.00	0.009	5.64	8.19	32.81	X		
Copper	UCL 95	High	45.05	0.004	0.158	0.0001	1690	0.14	1.00	0.009	33.29	3.61	812.91		X	
Lead	UCL 95	High	3.78	0.004	0.0132	0.0001	1690	0.14	1.00	0.009	17.24	0.003	288.93		X	
Mercury	UCL 95	High	0.09	0.004	0.00032	0.0001	2.7	0.00023	1.00	0.009	0.06	0.30	5.04	X		
Molybdenum	UCL 95	High	7.84	0.004	0.0274	0.0001	28.4	0.002	1.00	0.009	3.31	0.35	3.51		X	
Selenium	UCL 95	High	4.46	0.004	0.016	0.0001	3.8	0.0003	1.00	0.009	1.77	0.06	1.56			X
Silver	UCL 95	High	0.33	0.004	0.0012	0.0001	1.6	0.000	1.00	0.009	0.14	0.00	0.00			
Zinc	UCL 95	High	493.69	0.004	1.73	0.0001	1660	0.14	1.00	0.009	207.49	12.47	863.96		X	
Antimony	UCL 95	Low	0.54	0.003	0.00	0.0001	13.2	0.00	1.00	0.016	0.14	0.15	1.46	X		
Arsenic	UCL 95	Low	35.29	0.003	0.0918	0.0001	37.6	0.002	1.00	0.016	5.88	0.68	7.61		X	
Barium	UCL 95	Low	39.64	0.003	0.1031	0.0001	716	0.045	1.00	0.016	9.23	11.65	42.82	X		
Beryllium	UCL 95	Low	0.05	0.003	0.0001	0.0001	0.3	0.000	1.00	0.016	0.01	0.00	0.00			
Cadmium	UCL 95	Low	3.24	0.003	0.0084	0.0001	2.1	0.000	1.00	0.016	0.54	0.07	3.12		X	
Chromium	UCL 95	Low	7.12	0.003	0.0185	0.0001	308	0.019	1.00	0.016	2.36	7.09	28.42	X		

APPENDIX I2

SALT MARSH HARVEST MOUSE DOSE CALCULATIONS TBB DISPOSAL SITE NWSSBD CONCORD

Chemical[a]	Sample Location	Dose Type	[Pickleweed] (mg/kg)	IR_{prey} (kg/d)	Ingestion from Prey (mg/d)	IR_{soil} (kg/d)	[Soil] (mg/kg)	Ingestion from Soil (mg/d)	SUF	BW (kg)	Dose (mg/kg/day)	Low TRV	High TRV	Below Low TRV	Between Low and High TRVs	Above High TRV
Copper	UCL 95	Low	45.05	0.003	0.117	0.0001	1690	0.11	1.00	0.016	13.91	3.12	704.00		X	
Lead	UCL 95	Low	3.78	0.003	0.0098	0.0001	1690	0.11	1.00	0.016	7.21	0.003	250.22		X	
Mercury	UCL 95	Low	0.09	0.003	0.00023	0.0001	2.7	0.00017	1.00	0.016	0.03	0.29	4.87	X		
Molybdenum	UCL 95	Low	7.84	0.003	0.0204	0.0001	28.4	0.002	1.00	0.016	1.38	0.30	3.04		X	
Selenium	UCL 95	Low	4.46	0.003	0.012	0.0001	3.8	0.0002	1.00	0.016	0.74	0.06	1.35		X	
Silver	UCL 95	Low	0.33	0.003	0.0009	0.0001	1.6	0.000	1.00	0.016	0.06	0.00	0.00			
Zinc	UCL 95	Low	493.69	0.003	1.28	0.0001	1660	0.10	1.00	0.016	86.70	10.80	748.21		X	

Notes:

Ambient Hi — The high dose calculation using the Tidal Area 99th percent ambient value
Ambient Lo — The low dose calculation using the Tidal Area 99th percent ambient value
Amb Typical — The typical dose calculation using the Tidal Area 99th percent ambient value
BW — Body weight
DDT — Dichlorodiphenyltrichloroethane
IR_{prey} — Ingestion rate of prey
IR_{soil} — Ingestion rate of soil
kg/day — Kilograms per day
mg/d — Milligrams per day
mg/kg — Milligrams per kilogram
mg/kg/day — Milligrams per kilogram per day
NA — Not available
PAH — Polynuclear aromatic hydrocarbon
PCB — Polychlorinated biphenyl
[Pickleweed] — Concentration of chemical in pickleweed
[Soil] — Concentration of chemical in soil
SUF — Site use factor
TRV — Toxicity reference value
UCL — Upper confidence limit

a Chemicals were selected based on available TRV information
b The dose for the 95UCL was only calculated for chemicals with an HQ greater than 1
c Total DDTs are the sum of dichlorodiphenyldichloroethane, dichlorodiphenyldichloroethene, and DDT
--- Not applicable to the analysis

APPENDIX J

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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1.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The following sections identify the preliminary applicable or relevant and appropriate requirements (ARARs) for the NWSBD Concord TBB disposal site. ARARs are substantive federal and state environmental laws and regulations that provide cleanup levels or performance standards for the remedial alternatives to be developed for the TBB disposal site. The ARAR identification process begins during the planning stages of the RI and continues as alternatives are developed and evaluated in the FS. ARARs are finalized in the remedial action decision document. ARAR definitions are discussed in Section 1.1. Section 1.2 evaluates environmental requirements and identifies preliminary ARARs for the TBB disposal site

1.1 ARAR DEFINITIONS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, 42 United States Code [U.S.C.] Section [§] 9621[d]), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (U.S. EPA 1988a). A requirement must be determined to be both relevant and appropriate in order to be considered an ARAR.

The criteria for determining relevance and appropriateness are listed in 40 C.F.R. § 300.400(g)(2) and include the following:

- the purpose of the requirement and the purpose of the CERCLA action;
- the medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site;
- the substances regulated by the requirement and the substances found at the CERCLA site;
- any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site;
- the type of place regulated and the type of place affected by the release or CERCLA action;
- the type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action; and
- any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site.

According to CERCLA ARARs guidance (U.S. EPA 1988a), a requirement may be "applicable" or "relevant and appropriate," but not both. Identification of ARARs must be done on a site-specific basis and involves a two-part analysis: first, a determination whether a given requirement is applicable; then, if it is not applicable, a determination whether it is nevertheless both relevant and appropriate. It is important to explain that some regulations may be applicable or, if not applicable, may still be relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (U.S. EPA 1988b).

Tables included in this appendix present each potential ARAR with a preliminary determination of ARAR status (i.e., applicable, relevant and appropriate, or not an ARAR). For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release or response action contemplated, and whether the requirement was well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement did not meet the pertinent criteria. Negative determinations are documented in the tables of this appendix and are discussed in the text only for specific cases.

To qualify as a state ARAR under CERCLA and the NCP, a state requirement must be:

- a state law,
- an environmental or facility siting law,
- promulgated (of general applicability and legally enforceable),
- substantive (not procedural or administrative),
- more stringent than the federal requirement,
- identified in a timely manner, and
- consistently applied.

To constitute an ARAR, a requirement must be substantive. Therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered to be ARARs. Permits are considered to be procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or nonenvironmental, including permit requirements, are not considered to be ARARs. CERCLA 121(e)(1), 42 U.S.C. § 9621(e)(1), states that "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term onsite is defined for purposes of this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 C.F.R. § 300.5).

Nonpromulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may, however, be useful, and are "to be considered" (TBC). TBC (40 C.F.R. § 300.400[g][3]) requirements complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

Pursuant to U.S. EPA guidance (U.S. EPA 1988a), ARARs are generally divided into three categories: chemical-specific, location-specific, and action-specific requirements. This classification was developed to aid in the identification of ARARs; some ARARs do not fall precisely into one group or another. ARARs are identified on a site basis for remedial actions where CERCLA authority is the basis for cleanup.

Waivers from attaining specific ARARs may be obtained under certain conditions, as presented in Section 121(d)(4) of CERCLA as amended by SARA. The conditions are as follows:

- The remedial action selected is only part of a total remedial action that will attain the ARAR when completed.
- Compliance with the ARAR will result in greater risk to human health and the environment.
- Compliance with the ARAR is technically impractical from an engineering perspective.
- The remedial action selected will attain a standard of performance equivalent to the ARAR through use of another method or approach.
- With respect to a state ARAR, the state has not consistently applied or demonstrated the intention to consistently apply the standard, requirement, criteria, or limitation in similar circumstances for other remedial actions within the state.

Several of these waivers may be relevant to the TBB disposal site as a whole or to specific remedial alternatives and will require further technical evaluation. As the RI/FS and design phases progress, the applicability of the waivers will be assessed. The Navy may invoke a waiver if applicable, provided that the remedial actions are protective of human health and the environment.

As the lead federal agency, the DON has primary responsibility for identifying federal ARARs at the TBB disposal site. The Navy has formally requested ARARs from the state for all NWSBD Concord Tidal Area sites (WESTDIV 1993). Responses were received from the following state agencies:

- San Francisco Bay Regional Water Quality Control Board
- Department of Toxic Substances Control
- Department of Fish and Game
- San Francisco Bay Conservation and Development Commission

In a letter dated February 1999, EFA WEST requested ARARs from the state for the TBB disposal site. The information received from state agencies for the original four Tidal Area sites was not specific to the TBB disposal site and contained only generic references to state requirements. The Navy previously met with state regulators informally to discuss ARARs specific to the original four Tidal Area sites. Based on the meetings and the RI prepared for the Tidal Area sites, the Navy will describe below how state requirements apply to the TBB disposal site.

Section 1.2 below describes the environmental requirements that may be pertinent to the TBB disposal site and the preliminary ARARs identified. The ARARs preliminarily identified in this summary report may change as the RI/FS and remedy selection processes proceed. Such changes may include (1) screening out requirements identified as preliminary ARARs, or (2) identifying additional requirements as ARARs.

1.2 PRELIMINARY ARARS FOR TBB DISPOSAL SITE

The subsections below (1) evaluate chemical- and location-specific environmental requirements that may be pertinent to the TBB disposal site, and (2) identify preliminary ARARs for the TBB disposal site. Action-specific ARARs will be evaluated in the FS.

1.2.1 Chemical-Specific ARARs for Site 30, TBB Disposal Site

Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in the establishment of a cleanup level. The media that may be affected at the TBB disposal site include soil, sediment and groundwater.

Table 1 lists the preliminary chemical-specific ARARs for the TBB disposal site.

1.2.1.1 Soil and Sediment

RCRA Hazardous Waste and Land Disposal Restriction Requirements.

U.S. EPA and the states have been slow to develop criteria for the protection of human or ecological receptors in sediments. While U.S. EPA proposed national sediment criteria in 1998 to set pollution thresholds that sediments could not exceed, those criteria were withdrawn after consultation with the U.S. Army Corps of Engineers. Accordingly, the only federal ARARs for sediments applicable to this site are RCRA hazardous waste and land disposal restrictions. The applicability of RCRA requirements depends on whether the sediments contain listed or characteristic RCRA hazardous waste, whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement, and whether the activity at the site constitutes generation, treatment, storage, or disposal as defined by RCRA. Excavation of sediments containing RCRA hazardous waste constitutes generation of waste, to which RCRA requirements apply. RCRA requirements may also be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, and disposal for waste that is similar to RCRA hazardous waste.

The following requirements may be ARARs for soil and sediment.

The determination of whether a waste is an RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. The RCRA requirements at Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potential ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the TCLP. The maximum concentrations allowable for the TCLP listed in Cal. Code Regs. tit. 22, § 66261.24(a)(1)(B) are potential federal ARARs for determining whether the site has hazardous waste. If the site waste has concentrations exceeding these values it is determined to be a characteristic RCRA hazardous waste. See Section X1.4.1 for a more complete discussion of hazardous waste determination.

RCRA LDRs at Cal. Code Regs. tit. 22, § 66268.1(f) are potential federal ARARs for discharging waste to land. This section prohibits the disposal of hazardous waste to land unless (1) it is treated in accordance with the treatment standards of Cal. Code Regs. tit. 22, § 66268.40 and the underlying hazardous constituents meet the Universal Treatment Standards at Cal. Code Regs. tit. 22, § 66268.48; (2) it is treated to meet the alternative soil treatment standards of Cal. Code Regs. tit 22, § 66268.49; or (3) a treatability variance is obtained under Cal. Code Regs. tit. 22, § 66268.44. These are potentially applicable federal ARARs because they are part of the state-approved RCRA program. RCRA Treatment Standards for non-RCRA, state-regulated waste are not potentially applicable federal ARARs but they may be relevant and appropriate state ARARs.

1.2.1.2 Groundwater

There are no chemical-specific ARARs for groundwater at the TBB disposal site. Groundwater is not considered to be a source of drinking water. For aquifers with Class III characteristics, MCLs are neither applicable nor relevant and appropriate and are not used to determine preliminary actions goals.

1.2.1.3 TBCs

TBCs for the Site 30 TBB Disposal Site include:

- EPA Region IX PRGs. PRGs benchmarks are used to confirm that site conditions are protective of human health for all possible future uses.
- San Francisco Bay Ambient Sediment values (RWQCB 1998).

1.2.2 Location-Specific ARARs for Site 30, TBB Disposal Site

Location-specific ARARs are restrictions placed on the concentrations of hazardous substances or the conduct of activities as a result of the characteristics of the site or its immediate environment. For example, location of the site or proposed action in a flood plain, wetland, historic place, or sensitive ecosystem may trigger location specific ARARs. The location-specific ARARs for the TBB disposal site are associated with the potential presence of endangered or threatened species and with the location of the site near the Seal Creek Marsh, a wetland. Remedial actions taken at the site must be designed to avoid jeopardizing any endangered species. Table 1 lists the location-specific ARARs for the TBB disposal site.

Endangered Species Act of 1973

The Endangered Species Act (ESA) of 1973 (16 U.S.C. §§ 1531–1543) provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction. TheESA defines an endangered species and provides for the designation of critical habitats. Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. Under Section 7(a) of the ESA, federal agencies must carry out conservation programs for listed species. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented. Consultation regulations at 50 C.F.R. § 402 are administrative in nature and are therefore not ARARs. However, they may be TBCs to comply with the substantive provisions of the ESA.

The TBB disposal site provides potential habitat for the endangered salt marsh harvest mouse. Although no salt marsh harvest mice have been trapped at the site, this species is presumed to reside at the site due to the presence of pickleweed. As a result, the substantiveportions of the Endangered Species Act, Title 16 United States Code (USC) Section 1531 and its associated regulations at 50 CFR Part 17, Parts 222 and 402, are applicable to the TBB disposal site. In addition, the substantive portions of Fish and Game Code Sections 2080 that are more stringent than the Endangered Species Act are potential ARARs for the TBB disposal site. The FS will further evaluate compliance with these ARARs.

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) (16 U.S.C. §§ 1451–1464) and the accompanying implementing regulations in 15 C.F.R. § 930 require that federal agencies conducting or supporting activities directly affecting the coastal zone conduct or support those activities in a manner that is consistent with the approved state coastal zone management programs. A state coastal zone management program (developed under state law and guided by the CZMA) sets forth objectives, policies, and standards to guide public and private uses of lands and water in the coastal zone. California's approved coastal management program includes the San Francisco Bay Plan (Bay Plan) developed by the BCDC. The BCDC was formed under the authority of the McAteer-Petris Act, California Government Code § 66600 *et seq.*, which authorizes the BCDC to regulate activities within San Francisco Bay and the shoreline (100 feet landward from the shoreline) in conformity with the policies of the Bay Plan. The McAteer-Petris Act and the Bay Plan were developed primarily to halt uncontrolled development and filling of the Bay. Their broad goals include reducing Bay fill and disposal of dredged material in the Bay, maintaining marshes and mudflats to the fullest extent possible to conserve wildlife and abate pollution, and protecting the beneficial uses of the Bay. The Coastal Zone Management Act is relevant and appropriate and is, therefore, an ARAR.

As federally owned land, NWSBD Concord is outside the coastal zone pursuant to 16 U.S.C. §1453(1). Nevertheless, if any remedial activities affect any land or water use or natural resource of the coastal zone, the Navy will consult with the state coastal management agency in an effort to determine whether substantive requirements of the state coastal plan will be met.

Protection of Wetlands, Exec. Order No. 11990

Exec. Order No. 11990 requires that federal agencies minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists. The TBB disposal site includes a wetland; as a result, the Protection of Wetlands Executive Order No. 11990 and its implementing regulation at 40 CFR Section 6.302(a) and Appendix A are TBCs for the TBB disposal site. The FS will further describe how each remedial alternative analyzed in detail will comply with Executive Order 11990.

Floodplain Management, Exec. Order No. 11988

Under 40 C.F.R. § 6.302(b), federal agencies are required to evaluate the potential effects of action they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain. The TBB disposal site is in the 100-year floodplain. The FS will further describe how each remedial alternative analyzed in detail will comply with Executive Order 11988.

Clean Water Act (33 U.S.C. § 1344)

Section 404 of the Clean Water Act of 1977 governs the discharge of dredged and fill material into waters of the United States, including adjacent wetlands. Wetlands are areas that are inundated by water frequently enough to support vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mudflats, natural ponds and similar areas. Both the U.S. EPA and the U.S. Army Corps of Engineers have jurisdiction over wetlands. U.S. EPA's Section 404 guidelines are promulgated in 40 C.F.R. § 230, and the U.S. Army Corps of Engineer's guidelines are promulgated in 33 C.F.R. § 320.

Other location-specific requirements are not ARARs for the TBB disposal site because the circumstances that would make them ARARs do not exist at the site. The National Wildlife Refuge System Act is not an ARAR because no part of the TBB disposal site is associated with a national wildlife refuge. The Wild and Scenic Rivers Act is not an ARAR because there are no wild or scenic rivers (as designated by the act) associated with the TBB disposal site. The Wilderness Act is not an ARAR for the TBB disposal site because there are no wilderness areas associated with the site. The National Historic Preservation Act, Archeological and Historical Preservation Act, and Historic Sites, Buildings, and Antiquities Act are not ARARs for the TBB disposal site because there are no properties, historic or archeological data, or landmarks at the TBB disposal site that fall under the purview of those laws.

1.2.3 Action-Specific ARARs for Site 30, TBB Disposal Site

Due to the limited horizontal and vertical extent of contamination at Site 30 and the high concentrations of inorganic chemicals detected, it is most likely that excavation and off-site disposal will be the favored alternative in the FS when it is conducted. On-site treatment or encapsulation of contaminants are unlikely to be chosen for the site, for a variety of reasons. Full evaluation of action-specific ARARs for all considered alternatives will be presented in the FS.

TABLE 1

CHEMICAL-SPECIFIC ARARs
PRELIMINARY ARARs FOR THE TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

Requirement	Prerequisite	Citation	Preliminary ARARs Determination	Comments
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])				
Definition of RCRA hazardous waste	Soil and sediment	Cal.Code Regs., tit 22 §§§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1) and 66261.100	Applicable	The requirements of 22 CCR, Division 4.5, Chapter 14 are applicable to all alternatives for determining whether excavated material contains hazardous waste. These requirements may be relevant and appropriate to excavated material that is similar or identical to RCRA hazardous waste or non-RCRA hazardous waste
NA	Soil and sediment	EPA Region IX PRGs Ambient Sediment values (RWQCB 1998)	TBC	Guidance that is useful for setting cleanup goals for protecting human health and the environment from contaminated sediment and soil.
	Soil and sediment	San Francisco Bay Ambient Sediment Values (RWQCB 1998)	TBC	Guidance that is useful for setting cleanup goals for protecting human health and the environment from contaminated sediment and soil.

TABLE 2

LOCATION-SPECIFIC ARARs
PRELIMINARY ARARs FOR THE TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

Location	Requirement	Prerequisite	Citation	Preliminary ARARs Determination	Comments
Endangered Species Act of 1973 (16 U.S.C. §§ 1531–1543)					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	16 U.S.C. § 1536(A), (H)(1)(B)	Relevant and appropriate	Relevant and appropriate for Site 30 due to potential habitat for the endangered salt marsh harvest mouse. Action taken at the site must provide for the protection of this endangered species. Compliance with the location-specific ARAR will be evaluated in the FS.
Habitat upon which endangered species or threatened species depend	No person shall import, export, or take, possess, purchase, or sell within this state, any threatened or endangered species.	Threatened or endangered species	Fish and Game Code Sections 2080	Relevant and appropriate	Relevant and appropriate for Site 30 due to potential habitat for endangered species and other protected animals and plants

TABLE 2 (Continued)

LOCATION-SPECIFIC ARARs
PRELIMINARY ARARs FOR THE TAYLOR BOULEVARD BRIDGE DISPOSAL SITE

Location	Requirement	Prerequisite	Citation	Preliminary ARARs Determination	Comments
Coastal Zone Management Act (16 U.S.C. §§ 1451–1464)					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands there under and adjacent shore land.	16 U.S.C. § 1456(c) 15 C.F.R. § 930	Relevant and appropriate	Relevant and appropriate because remedial activities may affect land or water use, or natural resources of the coastal zone
Exec. No. 11990, Protection of Wetlands					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands.	Wetland meeting definition of Section 7.	40 C.F.R. § 6.302(a)	TBC	To be considered for Site 30 due to presence of wetlands.
Exec. Order No. 11988, Floodplain Management					
Within floodplain	Actions taken should avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values.	Action that will occur in a floodplain (i.e., lowlands) and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	40 C.F.R. § 6.302(B)	TBC	To be considered for Site 30 due to its location in a floodplain

APPENDIX K

RESPONSES TO AGENCY COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION

RESPONSE TO AGENCY COMMENTS ON DRAFT REMEDIAL INVESTIGATION FOR TAYLOR BOULEVARD BRIDGE DISPOSAL SITE TIDAL AREA NAVAL WEAPONS STATION SEAL BEACH DETACHMENT CONCORD CONCORD, CALIFORNIA

This document presents the Navy's responses to comments from the U.S. Environmental Protection Agency (EPA) on the Draft Remedial Investigation for Taylor Boulevard Bridge Disposal Site Tidal Area, Naval Weapons Station Seal Beach Detachment Concord, Concord, California dated February 21, 2001. The comments addressed below were received from EPA on May 31, 2001.

RESPONSES TO EPA

General Comments

1. **Comment:** **<u>Groundwater and Surface Water as Media of Concern</u>. The potential impact of soil/sediment contamination on groundwater and surface water at the site has not been determined. The draft RI (Page 4-3) states groundwater samples were not collected because 1) significant sediment contamination below 1-foot bgs has not been encountered and, therefore, it is unlikely that groundwater has been impacted and 2) remedial actions at this site will be based on sediment removal rather than groundwater treatment. First, since groundwater is shallow, it is likely that soil contamination adversely impacted groundwater at the site. In addition, Figure 5-2 (Potential Exposure Routes) shows that groundwater is a receiving media for on-site sources. Second, since this is a remedial investigation, the extent of contamination in all media should be addressed. The lack of characterization of groundwater contamination constitutes a data gap. Long-term groundwater monitoring may be warranted, especially if a removal action is not performed.**

Furthermore, the rationale provided on Page 4-3 for not collecting surface water samples at the site does not address the need for investigating the impact of soil contamination on surface water quality. In addition, Figure 8-2 shows surface water as a receiving media for on-site sources. Since remedial actions at this site are not solely based on risk to human health and the environment, but have to also meet Applicable or Relevant and Appropriate Requirements (ARARs) (i.e., Ambient Water Quality Goals (AWQCs)), the remedial management decision has to include consideration of AWQCs. For example, if based on a risk management decision, no removal actions will be performed, the Navy still has to meet AWQCs. Therefore, characterization of surface water contamination constitutes a data gap. The Navy should provide further rationale for not characterizing groundwater and surface water, or the Navy should revise the RI to describe how these data gaps will be addressed.

Response: The Navy does not propose to conduct further sampling of groundwater or surface water based on the rationale as presented in the draft RI. In a May 17, 1999 conference call between the Navy and regulatory agencies, there was agency concurrence with regard to this issue (TtEMI 1999c). The rationale for not conducting groundwater and surface water samples follows:

<u>Groundwater</u>

(1) The vertical extent of sediment contamination is well defined. Sediment samples below 1 foot bgs do not contain significant concentrations

of chemicals. The disposal site has been in place for decades and no evidence exists that chemicals have migrated vertically by leaching, as evidenced by the lack of soil contamination at depths below 1 foot bgs.

(2) Debris removal will eliminate the primary source of contamination at the site. Even if groundwater impacts were detected, remedial actions performed at the site to address groundwater would likely begin and end with removal of the debris and contaminated sediment source.

Surface Water

(1) The size of the TBB Disposal Site, relative to the drainage area that discharges to the portion of Seal Creek Marsh adjacent to the site, is so small that the site is not a significant contributor to surface water runoff (see RI Figure 1). As a result, potentially contaminated runoff from the site is unlikely to have a significant effect on water quality of the area.

(2) Because of the size of Seal Creek Marsh, the presence of nearby petroleum refineries to the west, and the transitory nature of surface water in the area, elevated concentrations of any surface water constituents cannot be assumed to have originated from the TBB Disposal Site.

(3) Even if it were possible to determine that surface water impacts within Seal Creek Marsh were attributable to the TBB Disposal Site, all remedial activities would be directed toward the removal of the debris and contaminated sources. Active remediation of surface water itself is unlikely.

(4) Establishing baseline conditions of surface water within Seal Creek Marsh is a complex task that could require establishment of reference areas for sampling and collection of multiple samples throughout the year. The cost would be difficult to justify, considering the presumably low risk of significant impact to surface water from a source area of such small size and the Navy's willingness to clean up the source.

(5) In December 2001, the RWQCB collected seven surface water samples in the Seal Creek Marsh directly offshore from the TBB Disposal Site. The RWQCB samples were analyzed for total and dissolved metals. For total metals, chromium was detected at one location. For dissolved metals zinc was detected at several locations. However, concentrations for both total and dissolved metals were well below the ambient water quality control values calculated based on a hardness of 400 mg/L. Although hardness values in samples collected ranged from 2,600 mg/L to 2,800 mg/L, 400 mg/L is the upper value allowed by the California Toxics Rule.

The RWQCB data support that the TBB Disposal Site is not a source of contamination to the Seal Creek Marsh. The RWQCB sample location map and sample results are provided in Appendix N.

2. **Comment:** **<u>Discussion of the Nature and Extent of Contamination</u>. In Section 5.1, the draft RI presents the results of the metals analyses. However, the implications of the results are not discussed. For example, 1) the concentration differences between samples collected from the aquatic and wetland/upland transitional habitats are not discussed, and 2) the analytical results are not compared to applicable action levels (e.g., Preliminary Remediation Goals (PRGs)). To make the presented results meaningful for the discussion of data gaps, please include a comparison between the metal concentration ranges at the site and applicable action levels. In addition, please discuss the concentration differences between the aquatic and wetlands/upland transitional habitats with respect to contaminant migration from the upland area to surface water and "hot spot" areas. The same comment applies to Section 5.2 (Organic Chemicals in Sediment Samples).**

Response: 1) Concentration differences between samples collected from the aquatic and wetland/upland transitional habitats were discussed in Sections 5.1 and 5.2. The extent of the debris was discussed in Section 5.3.

2) In the draft final RI report, Section 5.1 will be revised to include a comparison of site concentration to Tidal Area ambient concentrations. However, neither Section 5.1 or 5.2 will be changed to include a comparison between bulk chemistry and toxicity based benchmarks. Toxicity benchmarks are different for each receptor, therefore, comparisons were made in the report section specific to that receptor. For example, for the human health risk assessment, chemical concentrations are compared to preliminary remediation goals (PRGs) in Section 7.1. For plants, a comparison to Oak Ridge National Laboratory plant toxicity benchmarks in conducted in Section 8.4.1. Chemicals of potential ecological concern for invertebrates were determined based on a comparison to effects range-low (ER-L) values in Section 8.5.1. Because the toxicity benchmarks are different for each receptor, the list of chemicals of potential concern is also different.

3. **Comment:** **<u>Organic Chemical Investigation</u>. The draft RI only discusses the extent of inorganic chemicals in sediment. Since organic chemicals have also been detected, please revise the RI to discuss organic chemicals in the discussion of the nature and extent of contamination, and in the human health and ecological risk assessments.**

Previous U.S. EPA comments and meeting discussions regarding the RI Work Plan included the possibility of analyzing soil/sediment for PCBs, pesticides, and dioxins. The large amount of debris found at the site warrants further investigation as potential industrial waste. Therefore, it appears that there is a data gap with respect to the analysis of PCBs and pesticides in soil/sediment, groundwater, and surface water. Please address this data gap by proposing additional investigation.

Lastly, for completeness, the RI should describe how the Navy determined that analyzing sediment samples for dioxins was not warranted.

Response: Organic chemicals were discussed in Section 5.2 of the nature and extent section of the draft RI. Detected organic chemicals were evaluated in the human health risk assessment. The conclusion of the screening level assessment was to focus the baseline assessment on the inorganic risk drivers; organic chemicals were not considered significant risk drivers and were also collocated with inorganic chemicals.

There is no evidence to suggest that industrial disposal occurred at the TBB disposal site. The site is small and old, and access to it is difficult. Furthermore, a large-scale landfill that was used for waste disposal for many years (Tidal Area Landfill, Site 1) is nearby. Analytical data collected in previous TBB site investigations indicate that chemical concentrations decrease with increasing depth. Aerial photographs dating from 1939 to 1996 also show that the site has not been graded for more than 60 years, providing further evidence that disposal wastes at the TBB site are still visible as surface debris. Furthermore, the debris itself, blue-colored glass bottles and ceramic fragments, indicates that the waste is not recent but is instead at least 40 to 50 years old. The high metal concentrations detected in soil and sediment samples are likely due to the burned metal and glass debris observed on the site. Because there is no identifiable source and no indication that disposal of industrial waste has occurred at the site, sampling for pesticides and PCBs was not warranted.

Although samples previously collected were not analyzed for dioxins, they were analyzed for pentachlorophenol (PCP). PCP was detected in three area B samples at concentrations slightly above the detection limit; PCP was not detected in samples from area A (see Appendix A-4). Because PCP was not detected at appreciable levels at the TBB disposal site, it is unlikely that dioxins, a by-product of PCP, would be present at elevated concentrations. Thus, additional sampling for dioxins was not warranted. Dioxins are ubiquitous in the environment as a result of global atmospheric transport and their environmental persistence, so they may exist at very low concentrations in soil and sediment at the TBB disposal site.

4. **Comment:** **<u>Delineation of the Nature and Extent of Contamination</u>. As shown in Figures 5-22 through 5-26, the extent of contamination above the Tidal Area ambient levels has not been defined to the north (e.g., north of location SS200) and southwest (e.g., southwest of location 309CSPWSS) of the site. However, the draft RI does not discuss areas where the extent of debris and chemical contamination has not been defined. For completeness, please include a discussion of the lateral and vertical extent characterization with respect to appropriate action levels. The**

lateral and vertical extent of debris and sediment contamination should be defined prior to, or as part of the remedial action.

Response: The lateral and vertical extent of the debris are characterized on Figures 3-1 and 5-27. Figure 8-6 shows the primary areas of surface and subsurface debris, and scattered surface debris in relation to the risk footprint for ecological receptors. The human health risk footprint will be added to Figure 8-6 in the draft final RI.

5. **Comment:** **<u>Lead isopleth</u>. The RI Work Plan was based on addressing the area that will remain after soil/sediment within the 250 mg/kg lead isopleth was removed to a depth of one foot. However, it appears that in the process of preparing the RI, the Navy changed the 250 mg/kg isopleth to a 400 mg/kg isopleth to correspond with a human health Preliminary Remediation Goal (PRG). The text in the Executive Summary, page ES-3, states, "all samples with detected lead concentrations greater than 400 mg/kg (the residential PRG for lead) were grouped into one area, hereafter referred to as Area A".**

If the Navy no longer plans on removing the soil within the 250 mg/kg lead isopleth, and due to the change in the area of interest to 400 mg/kg lead following the most recent (Spring 2000) sampling specified in the Work Plan, the RI should be revised to address the following:

- **COPEC selection in the SERA (as part of the Work Plan) was based on chemicals *outside* the 250 mg/kg lead isopleth exceeding sediment screening benchmarks (as stated in the RI, page 8-2).**
- **The RI states, "the purpose of the Spring 2000 sampling for the Ecological Risk Assessment (ERA) was to identify locations outside the 250 mg/kg isopleth that may pose the greatest risk to benthic receptors and pickleweed." However, the Navy has included Area A (inside the lead isopleth) in the BERA. Therefore, the pickleweed, invertebrate, and toxicity test sampling locations do not provide sufficient coverage to provide a worst-case scenario (i.e., data from the most contaminated sediment) from which risk to ecological receptors in Area A can be characterized.**
- **Similarly, the screening-level human health risk assessment was conducted to confirm that residual contamination expected to be present after site remediation is completed will not pose a threat to human health. If only areas outside the 250 mg/kg lead isopleth were sampled in preparation for the RI, yet the "risk footprint" was changed to only areas in which lead exceeds 400 mg/kg, it is unclear how the Navy plans to address areas in which lead concentrations fall between these two values.**

Response: Based on a reconsideration of the TBB Disposal Site data, the problem statement presented in the QAPP (TtEMI 2000) was amended prior to the preparation of RI. (ref erence May 17, 2000, NWSSB Detachment Concord Meeting Minutes). The 250 mg/kg lead isopleth was considered to be arbitrary with respect to estimating ecological risk and considering site habitats. Thus, for the BERA in the RI, the site was not discussed in terms of areas inside and outside of a 250-mg/kg lead isopleth but rather as a single area with respect to evaluating risk to ecological receptors. For human health, all samples with detected lead concentrations greater than 400 mg/kg (the residential PRG for lead) were grouped into one area (Area A), and the remainder of the samples were into Area B. Specific responses to bulleted items follow:

- COPEC selection in the BERA was based on the entire site, not areas just outside the 250 mg/kg lead isopleth.
- Based on the small size of the site and a planned removal of the debris, it was determined that one sample each from the northern, central, and southern areas of the site would be sufficient for the BERA. Sample locations for pickleweed and invertebrate tissue, and toxicity data were randomly selected in each area. As it turned out, concentrations in the southern area sample could be considered representative of a worst case scenario with lead at 2,300 mg/kg and zinc at 2,270 mg/kg.
- Locations of which lead concentrations were between 250 and 400 mg/kg are concern to ecological, not human, receptors, and are addressed in the BERA.

6. **Comment:** **<u>Ambient Screening Values</u>. The "Concord Tidal Area Ambient" values for soil, specified in the Report as the 99 percent upper confidence limit of the mean (99% UCL), were used as screening criteria to select the list of inorganic chemicals of concern for the human health and ecological risk assessments. These values are not consistent with previous ambient levels established for NWSSB Detachment Concord, as the 80 percent Lower Confidence Limit (LCL) of the 95th percentile (Technical Memorandum, Establishment of Ambient Metals Concentrations in Tidal Area Soils). The difference between these two values is considerable for some inorganics. For example, the Tidal Area Ambient value for lead is 61 mg/kg, while the 99% UCL value used in the draft RI is 95 mg/kg.**

The rationale for deriving a new set of ambient values in the draft RI is not clear, and the use of the 99% UCL as a screening criteria for the human health and ecological risk assessments is not sufficiently conservative. Use of upper limit values as a threshold increases the likelihood that concentrations that are representative of contamination will be mistakenly identified as being within the background or ambient

distribution. The RI should be revised to use the original Tidal Area Ambient values (i.e., the 80 percent LCL of the 95th percentile) as presented in the referenced document. In addition, the human health and ecological risk assessments should be revised to include as COPCs those metals for which the maximum concentration exceeds the established ambient concentrations.

Response: The ambient concentrations were initially derived in the July, 1996 technical memorandum entitled Estimation of Ambient Metal Concentrations in the Tidal Area Soils (PRC 1996). The original ambient benchmarks were the 80% lower confidence limit on the 95th percentile for each metal. In written comments (April 16, 1997; July 23, 1997; October 30, 1997) for the draft Concord Tidal Area Baseline Ecological Risk Assessment, DTSC requested that the Navy recalculate these ambient benchmarks. In subsequent telephone conversations with DTSC (October 27, 1997 and October 29, 1997), the Navy agreed that the existing probability plots in the 1996 technical memorandum would be revised for metals with a low frequency of detections using proxy or "dummy" values (the lowest detected value) as surrogates for non-detected metals. Concurrently, it was also agreed that the Navy would establish a 99th percentile ambient level for use as an ambient benchmark that would replace the existing benchmarks (e.g., 80% lower confidence interval on the 95th percentile). The technical memorandum was revised to incorporate these new methods and revised benchmarks. This revised technical memorandum was intended to be Appendix E in the June, 1999 Remedial Investigation, Tidal Area Sites 1,2,9, and 11, Naval Weapons Station, Seal Beach Detachment, Concord, California; Qualitative Ecological Risk Assessment Report, but inadvertently the original 1996 technical memorandum (rather than the new Appendix E) was appended.

The Navy believes that these 99th percentile ambient benchmarks for metals as calculated and described in the revised technical memorandum are appropriate for use in the screening process to select COPECs for soils and sediments at Concord in the San Francisco Bay Area. Hence, these revised ambient benchmarks were used in the Taylor Boulevard Bridge risk assessment screening process to identify COPECs for terrestrial plants, aquatic invertebrates, aquatic birds, and the salt marsh harvest mouse. These ambient benchmarks are the 99th percentile for each metal as shown in Appendix E-1 of the attached revised technical memorandum (e.g., Appendix E).

Footnote a in Tables 8-6, 8-7, 8-11, 8-12, 8-18, and 8-19 of the Taylor Boulevard Bridge ecological risk assessment will be updated to include the correct citation, and the heading in the second column of each table will be changed to read "99th Percentile." The report text will be modified where appropriate to indicate that the 99th percentile, Tidal Area ambient benchmarks were used in the screening process (as described in the report) to select COPECs for terrestrial plants, aquatic invertebrates, aquatic birds, and the salt marsh harvest mouse.

7. **Comment:**

<u>Selection of Chemicals of Potential Ecological Concern (COPECs)</u>. The ecological risk assessment does not provide a comprehensive evaluation of risk from all chemicals detected on the site above appropriate screening benchmarks. For example, separate groups of chemicals were assessed for different receptor groups, and COPECs for benthic invertebrates were selected only from samples in which the mean Effects Range-Median (ER-M) quotient exceeded 1.5 and the bioaccumulation factor exceeded 1. Additionally, the process used to select COPECs in the screening-level ERA is not clear. A limited number of sediment samples were analyzed for organic constituents, yet these results were not included in the ERA. According to the sediment analytical data presented in Appendix D-2, it appears that some chemical groups (low- and high- molecular weight PAHs) were detected in sediment samples above sediment screening benchmarks. However, these data are not incorporated into the ecological risk evaluation.

The ERA should be revised to provide a reasonable estimate of risk based on available data from the site, and should evaluate all chemicals that are present above conservative risk-based screening benchmarks.

Response:

Chemicals of potential ecological concern (COPEC) for the TBB Disposal Area were identified separately for plants, invertebrates, and birds and mammals. For plants and benthic invertebrates, COPECs were identified based on a comparison of the 95th upper confidence limit of the mean (UCL95) soil concentration compared to: 1) ambient values from site-specific sampling at the Tidal Area and from regional San Francisco Bay studies and 2) toxicity-based benchmarks. For birds and mammals, COPECs were identified based on a comparison of the UCL95 to ambient values.

Risks to each type of receptor from chemicals identified as COPECs were then characterized using a weight-of-evidence approach to determine whether the site poses a significant risk to ecological receptors that warrants additional evaluation or a response action. For benthic invertebrates, mean ER-M quotients and bioaccumulation were considered in this weight of evidence evaluation.

The conclusion of the screening level assessment was to focus the baseline assessment on the inorganic risk drivers; organic chemicals were not considered significant risk drivers and were also collocated with inorganic chemicals.

8. **Comment:** **<u>Objectives of the Remedial Investigation</u>. The objectives of the RI as outlined in the Executive Summary include: "Characterize the nature and extent of soil and sediment contamination for the purpose of developing and evaluating effective remedial alternatives" and "Collect data to support initial Feasibility Study (FS) activities". It is unclear how these objectives were met. To better evaluate how these objectives were met, please indicate what action levels (e.g., Tidal Area Ambient Values) were used to define the lateral and vertical extent of contamination, how Chemicals of Concern (COCs) were selected, and what analyses were performed to support initial FS activities.**

Response: Action levels used to define lateral and vertical extent of contamination and methodologies by which COECs were determined are provided in the executive summary under the heading of baseline ecological risk assessment. All analyses performed for the RI will be used to support FS activities.

9. **Comment:** **<u>Aerial photographs</u>. The Site History section of the draft RI refers to aerial photographs that were taken between 1952 and 1996. Please include copies of these aerial photographs in the revised RI. In addition to these black and white copies, please provide access to the original photographs to U.S. EPA for examination. If steroscopic images are available, please make these images available as well.**

Response: The quality of the photocopied aerial photographs would be too poor to make out any distinguishable features of the TBB site, especially given it's small size. Thus, the Navy will not include copies of aerial photographs in the RI. However, the U.S. EPA can schedule an appointment with the Navy for access to the original aerial photographs.

10. **Comment:** **<u>Administrative record and document history</u>. The draft RI refers to discussions and agreements between the Navy and regulatory agencies. Please provide specific references to agency correspondence and involvement (e.g., written agreements made in the formulation of the Work Plan for the RI) as part of the report.**

Response: References and the document history for the TBB disposal site are provided below.

TtEMI. 1999a. "Draft Summary Report and Field Work Plan for Supplemental Sampling at Taylor Boulevard Bridge Disposal Site, Tidal Area, NWSSB, Detachment Concord." April 28.

TtEMI. 1999b. "Response to Agency Comments on Draft Summary Report and Field Work Plan for Supplemental Sampling at Taylor Boulevard Bridge Disposal Site, Tidal Area, NWSSB, Detachment Concord." July.

TtEMI. 1999c. "Summary of discussion of Response to Agency Comments on Draft Summary Report and Field Work Plan for Supplemental Sampling at Taylor Boulevard Bridge Disposal Site, Tidal Area, NWSSB, Detachment Concord." July 23.

TtEMI. 1999d. "Final Summary Report and Field Work Plan for Supplemental Sampling at Taylor Boulevard Bridge Disposal Site, Tidal Area, NWSSB, Detachment Concord." August 6.

TtEMI. 2000a. "Final Field Sampling Plan for Supplemental Sampling at Taylor Boulevard Bridge Disposal Site, Tidal Area, NWSSB, Detachment Concord. January 4.

TtEMI. 2000b. "Quality Assurance Project Plan for Taylor Boulevard Bridge Disposal Site, Tidal Area, NWSSB, Detachment Concord. January 4.

TtEMI. 2000c. "Meeting Minutes - Deviations from Final Summary Report and Field Work Plan for Supplemental Sampling at Taylor Boulevard Bridge Disposal Site, Tidal Area, NWSSB, Detachment Concord." May 17.

Specific Comments

1. **Comment:** <u>Section 4.1, Soil and Sediment Investigations, page 4-2</u>: **This section should include a discussion of the rationale for not sampling for dioxins. Additionally, the text states that metals concentrations in the deeper samples appear to be within the "estimated ambient limit range". Please provide a reference to support this statement.**

   Response: Although samples previously collected were not analyzed for dioxins, they were analyzed for pentachlorophenol (PCP). PCP was detected in three area B samples at concentrations slightly above the detection limit; PCP was not detected in samples from area A (see Appendix A-4). Because PCP was not detected at appreciable levels at the TBB disposal site, it is unlikely that dioxins, a by-product of PCP, would be present at elevated concentrations. Thus, additional sampling for dioxins is not warranted. Dioxins are ubiquitous in the environment as a result of global atmospheric transport and their environmental persistence, so they probably exist at very low concentrations in soil and sediment at the TBB disposal site.

2. **Comment:** <u>Section 4.2, Data gaps, Surface Water, page 4-3</u>: **The report states that Seal Creek Marsh shows little tidal influence, yet seasonal changes in the pond water elevation near the TBB site are significant (up to 4 feet). The Navy also states that no ditches or water channels lead from the TBB site to Seal Creek Marsh, and that transport of chemicals via surface water**

would be from runoff via overland flow.

Elevated lead concentrations were detected in the marsh and the portion of the disposal site that is regularly inundated with water. For example, samples SB103 and 309SSSS in the southern portion of the marsh, samples 309SSCS and SS204 in the central portion of the marsh, and sample SS200 in the northern portion of the marsh, have concentrations of lead that exceed sediment screening benchmarks. Some of these locations are located 30 feet to 50 feet away from the outline of what is called the disposal area. It is unclear why metals concentrations are elevated here if they are not due to contaminant migration via overland surface water runoff.

Since water levels at the TBB disposal site apparently change significantly throughout the year, and since overland flow is the main drainage pattern from the TBB disposal site, it appears likely that contaminants are transported from highly contaminated areas at the TBB disposal site into Seal Creek Marsh. Therefore, the issue of contaminant migration between the TBB disposal site and Seal Creek Marsh via surface water should be further discussed.

Response: All of the locations mentioned by the reviewer, SB103, 309SSSS, 309SSCS, SS204, and SS200, fall within in the boundary of the debris as shown in Figure 8-6 in the draft RI. The debris is the primary source for elevated metals in sediment, not contaminant migration via overland surface water runoff.

3. **Comment:** **Section 4.3, Ecological Risk Assessment Sampling, page 4-4: The text states that based on the results of the screening-level ERA, concentrations of metals represent a greater risk to ecological receptors. However, according to the sediment analytical results presented in Appendix D-2, low molecular weight PAHs and high molecular weight PAHs were detected above their respective Effects Range-Low sediment screening values (NOAA SQuiRT, 1999). The text should be revised to describe the process used to select COPECs in the screening-level ERA.**

Response: The conclusion of the screening level ERA (TtEMI 1999) was to focus the baseline assessment on the inorganic risk drivers; organic chemicals were not considered significant risk drivers and were also collocated with organic chemicals. Although PAHs exceeded ER-Ls, concentrations were below the ER-M indicating minimal risk. Further, locations where the ER-L for PAHs was exceeded, were inside the risk footprint where a future remedial action to remove contaminated sediment is planned.

4. **Comment:** **Section 4.3.1.2, Sediment Collection, page 4-5: Sediment samples were composited from three regions of the site for toxicity testing, amphipod tissue collection, and metals analysis. The rationale for compositing sediment samples is unclear, since results do not represent a range of concentrations but an entire area of the site. The results do not provide**

spatial resolution that will contribute to risk-management decision-making.

For example, according Figure 3-1, composite sample 309SSCS consists of sediment from locations SS204, SB15, and SB102. Concentrations of zinc, selenium, lead, and chromium measured in the middle to high range in sample SB15 would have been"diluted" by relatively lower metals concentrations in sample SS204. The RI should be revised to provide the rationale for collecting composite sediment samples, and to discuss the limitations associated with using this data for decision-making.

Response: The rationale for compositing the sediment samples was to evaluate a region of the site and not a specific location as it was not possible to collect sufficient amphipod tissue required for laboratory analyses from one location. The composited sample represents sediment from the same areas from which amphipods were collected.

5. Comment: <u>**Figures 5-22 through 5-26**</u>**: The figures do not include a legend for what appear to be either topographic or groundwater elevation contour lines (i.e., the lines labeled "6", "8", and "10"). For clarity, please include an explanation for these lines in the figure legends.**

Response: An explanation of topographic elevation contour lines will be added to figure legends.

6. Comment: <u>**Figure 5-27**</u>**: The figure shows that the vertical extent of the debris in several boreholes along cross-section A-A' was not defined. Therefore, it appears that additional investigation regarding the vertical extent of the debris is warranted. Since one of the objectives of the RI was to define the extent of the debris, please provide the rationale for not proposing additional investigations to determine the vertical extent of the debris.**

In addition, the deepest depth investigated was 3.5 feet below ground surface. Since groundwater at the Site is expected to occur at shallow depths, it should be verified that debris is not submerged and in contact with groundwater. If it is determined that the debris is in contact with groundwater, groundwater sampling is recommended to determine whether the high metals concentrations detected in soil at the Site are not adversely affecting groundwater quality. A full suite chemical analysis should be performed on all groundwater samples.

Last, the figure indicates that the lateral extent of the debris near DB21 has not been determined. It is unclear how far the surface debris extends into the marsh. The Navy stated that surface debris was visible in the marsh, but was not further investigated. Therefore, it is recommended that the lateral extent of shallow surface debris be further delineated.

Response: At locations where the deepest depth investigated was 3.5 feet bgs, debris came in contact with groundwater, at which point it became impossible to investigate any further. The rationale for not proposing additional investigations to determine the vertical extent of the debris, is that the Navy is proposing a remedial action to remove the depth of the debris, thus removing the source of any contamination to the groundwater.

The extent of debris in the marsh was estimated by probing the submerged sediments of the offshore area with a shovel and a 5-foot length of plastic pipe. Using this probing method, debris (particularly glass fragments) could be "felt" to determine its offshore extent. Shallow holes (approximately 0.5 foot below the sediment surface) were also dug in the submerged sediment, and sediment was brought to the surface to visually identify debris. Based on these methods, debris appears to extend about 10 to 20 feet offshore from the debris area identified on the "wetland and upland transitional" portion of the site (see Figures 3-1 and 5-27). This debris appears to extend down 1 to 2 feet below the sediment surface. In the area south of the peninsula, about 6 inches of sediment covers the debris. The debris appears to be heaviest close to the shoreline and is mixed with sediment in most areas. The stippled offshore area shown on Figure 3-1 delineates an area of scattered surface debris, based on sediment probing conducted while traversing this area.

7. **Comment:** **<u>Section 7.1.2, Identification of Chemicals of Potential Concern, page 7-3</u>: The text states that inorganic chemicals were removed from the list of COPCs if the maximum detected concentration was below the 99th percentile of the ambient metal distribution, and refers to Table 7-1. However, Table 7-1 does not present 99th percentiles of the ambient distribution. Rather, the values presented in Table 7-1 are the 99 percent upper confidence limit (UCL) of the arithmetic mean. Please resolve this discrepancy. In addition, the use of either the 99th percentile or the 99 percent UCL of the mean as the comparator for ambient concentrations represents an unacceptably high value. Use of upper limit values as a threshold increases the likelihood that concentrations that are representative of contamination will be mistakenly identified as being within the background or ambient distribution. Further, the use of the 99th percentile is not consistent with previous ambient levels established for NWSSB Detachment Concord as the 80 percent LCL of the 95th percentile (Technical Memorandum, Establishment of Ambient Metals Concentrations in Tidal Area Soils). Further explanation and/or justification is required for the use of the 99th percentile to represent ambient levels for metals at the disposal area. We recommend that metals concentrations in soil be compared to previously established background levels, as defined by the 80 percent LCL of the 95th percentile. The risk assessment should be revised to include as COPCs those metals where the maximum concentration exceeds those established and accepted ambient levels.**

Response: The ambient benchmarks used in the COPC selection process are indeed the 99th percentiles of the ambient metal distributions. The heading in the second column of Table 7-1 will be revised to reflect such. The rationale underlying use of the

99^{th} percentile in COPC selection is outlined in General Comment Number 6.

8. **Comment:** <u>**Section 7.2.3, Exposure Points and Exposure Point Concentrations, page 7-5**</u>**: The text in this section notes that, "inorganic chemical concentrations in surface soils and sediments (0 to 1 foot bgs) are significantly higher than those in deeper samples (greater than 1 foot bgs)." Insufficient justification and/or explanation is provided for the inclusion of samples collected at depths greater than 1 foot bgs within the Area A footprint in combination with surface and subsurface data collected outside this area, designated as Area B. Unless evidence can be presented that such vertical stratification of contaminant concentrations is not apparent outside the Area A footprint, then the resulting exposure point concentrations for Area B may be biased low. Please provide a discussion of the vertical distribution of inorganic chemical concentrations outside of the Area A footprint.**

Response: As indicated on page 7-5 of the text, soil and sediment data for the TBB disposal site show vertical stratification of inorganic chemicals (primarily lead) at the site, including some locations outside Area A. It is anticipated the soil and sediment removed from the site will, at a minimum, contain those locations designated as Area A. Consequently the data set for Area B contains some locations with elevated lead concentrations. However, these concentrations do not exceed the residential PRG of 400 mg/kg, so they are not included in Area A.

9. **Comment:** <u>**Section 7.3.1, Toxicity Values, page 7-7**</u>**: Although this section is titled "Toxicity Values," the text discusses only US EPA Region 9 PRGs. No toxicity criteria are presented anywhere in the risk assessment. US EPA defines toxicity criteria as "numerical expressions of a substance's dose-response relationship" (US EPA, 1989). PRGs represent chemical-specific concentrations in environmental media that correspond to specified levels of carcinogenic risk or noncarcinogenic hazard based on specific exposure assumptions as well as toxicity criteria. For clarity, the exposure assumptions and the toxicity criteria used to calculate the Region 9 PRGs should be presented.**

Response: Since EPA Region IX PRGs were used to assess toxicity, toxicity values of individual chemicals as well as the exposure parameters and equations used to calculate the PRGs were not included in the human health risk assessment. The toxicity values, exposure parameters, and equations used to calculate the PRGs can be found in the EPA Region IX PRG memorandum referenced in the text. No changes will be made in response to this comment.

10. **Comment:** <u>**Section 7.4.1.1, Carcinogenic Risks, page 7-9**</u>**: The text refers to a US EPA memorandum regarding the role of the baseline risk assessment in Superfund remedy selections, as well as the target risk range as outlined in the NCP. While consideration of the NCP risk range is an integral part of the remedial decision process, any discussion of the risk management range**

within the risk assessment itself is inappropriate. The agency has clarified its position on the role of the risk assessor and risk manager on many occasions, most recently in its 1995 memorandum "Policy for Risk Characterization (US EPA, 1995). Risk assessors "are charged with (1) generating a credible, objective, realistic, and balanced analysis; (2) presenting information on hazard, dose-response, exposure and risks; and (3) explaining confidence in each assessment by clearly delineating uncertainties and assumptions along with the impacts of these factors...on the overall assessment. They do not make decisions on the acceptability of any risk level for protecting public health or selecting procedures for reducing risks." Accordingly, risk management discussions and references to the risk management range should be removed from Section 7.

Response: The text in Section 7.4.1.1 regarding the target risk range is presented solely to aid the public and individuals in the Navy and regulatory agencies who are less familiar with the risk assessment process in interpretation of the risk assessment results. Section 7.5 of the risk assessment does state whether or not the risk level is within EPA's target risk range. However, no recommendations or risk management decisions are made in the report based on the results of the risk assessment. No changes to the text will be made in response to this comment.

11. **Comment:** **<u>Section 7.4.3, Uncertainties, pages 7-13 to 7-16</u>: The text in these sections should note that although lead is evaluated in terms of estimated blood-lead concentrations, which provides an estimate of the potential for adverse neurological effects, US EPA also considers lead to be a probable human carcinogen. However, the Agency has noted that quantification of the cancer risk involves many uncertainties, some of which may be unique to lead, and that current knowledge of lead pharmacokinetics indicates that an estimate derived by standard procedures would not truly describe the potential risk. Thus, the Carcinogen Assessment Group recommends that a numerical estimate not be used. However, the uncertainty discussion should discuss the likelihood that the carcinogenic risks presented in the risk assessment for NWSSB Detachment Concord would be greater if the carcinogenic potential of lead were numerically evaluated. Similarly, total hazard indices would be greater if noncarcinogenic effects of lead were numerically included in the totals.**

Response: Section 7.4.3.4 will be added to incorporate the following discussion on uncertainties associated with exposure to lead:

Lead

As discussed on page 7-11, lead is evaluated separately by comparison of site soil concentrations to the lead PRG. Although human evidence is inadequate, EPA considers lead to be a probable human carcinogen based on rat and mouse bioassays which showed statistically significant increases in renal tumors with dietary and subcutaneous exposure to soluble lead salts (EPA 2000). Lead also contributes to noncancer health effects such as changes in cognitive and behavioral functions in children and can produce premature deliveries and spontaneous abortions in women.

While the degree of uncertainty regarding the health effects of lead is quite low, quantifying the cancer risk or noncancer health hazards of lead involves many uncertainties, some of which may be unique to lead. No toxicity criteria exist for lead, and the EPA Region IX residential and industrial PRGs do not correspond to a cancer risk of 1 ´ 10-6 or a hazard quotient of 1. Consequently, cancer risk and noncancer health hazard estimates presented in this human health risk assessment for the TBB Disposal Site would be greater if the carcinogenic and noncarcinogenic potential for lead were numerically quantified.

12. **Comment:** **Section 7.4.3.2, Exposure Assessment, page 7-14: The text states that exposure point concentrations "based on the UCL_{95} are likely to overestimate concentrations and associated risk at the site" US EPA disagrees with this statement. According to US EPA, 1992, the concentration term in the intake equation represents an estimate of the arithmetic average concentration for a contaminant based on a set of site sampling data. Because of the uncertainty associated with estimating the true average concentration at a site, the 95 percent upper confidence limit (UCL) of the arithmetic mean should be used for this variable. The 95 percent UCL provides reasonable confidence that the true site average will not be underestimated, and its use can account for the variability associated with limited data sets. As the degree of site characterization increases, uncertainties decrease and the UCL moves closer to the true mean. In such instances, the use of either the true mean or the UCL will produce similar results. However, in justifying the use of the UCL_{95} as the exposure point concentration in Section 7.3.2 on p. 7-6, the Navy states that the 57 soil and sediment samples collected at the disposal site are adequate to characterize the nature and extent of chemical contamination. It is not appropriate for the Navy to simultaneously claim that it has adequately characterized the site and that the data are limited such that the UCL_{95} is not an accurate predictor of the mean. As such, the statement that use of the UCL_{95} as the exposure point concentration is likely to overestimate the site risk is not acceptable and should be deleted.**

Response: The last sentence of the paragraph will be revised to read, "The EPCs based on the maximum concentration are likely to overestimate concentrations and associated risks at the site."

13. **Comment:** **Tables 7-2 and 7-3: These tables present exposure point concentrations for both central tendency exposures (CTE) and reasonable maximum exposure (RME). The values presented in the CTE column are identified as the lesser of the maximum detected concentration or the arithmetic mean. Use of the arithmetic mean as the concentration term when evaluating CTE is not acceptable. According to US EPA, 1992, the 95 percent UCL should be used as the average concentration in *both* average and RME evaluations in Superfund risk assessments. In addition, no CTE evaluation is presented in the risk assessment for the disposal area. As this column is irrelevant as well as misleading, it should be deleted from the tables.**

Response: The above referenced comment will be removed from Tables 7-2 and 7-3.

14. **Comment:** **Section 7.4.2.1, Area within the 400- Milligram per Kilogram Lead Isopleth (Area A), page 7-11; Section 7.4.2.2, Area Outside of the 400- Milligram per Kilogram Lead Isopleth (Area B), page 7-12; Section 7.4.3.1, Data Evaluation and Chemicals of Potential Concern Selection Process, pages 7-13 through 7-14: The text in these sections presents information regarding "background" concentrations of PAHs urban and rural soils (presumably in the United States, though this is not specified), as well as for iron in both California and the United States. Given the heterogeneous nature of soil types in both California and the United States, these discussions appear to have little relevance to PAH and iron concentrations detected at the NWSSB Detachment Concord. What would be relevant here are background (or ambient) concentrations of these analytes in the specific area and soil types representative of uncontaminated areas of the base. In addition, the text notes that detected concentrations of benzo(a)pyrene are within the range of typical background for rural soils, while detected concentrations of benzo(b)fluoranthene are within the range of typical background for urban soils (while exceeding the range of background for rural soils by approximately two orders of magnitude). Even while overlooking the fact that it is inappropriate for the Navy to pick and choose soil types (i.e., rural vs. urban) based on whichever seems to have the highest background concentration for the analyte of concern, the discussions in these section should be deleted unless background or ambient concentrations specific to the NWSSB Detachment Concord can be provided.**

Response: Consistent with agency guidance, background levels for organic contaminants have not been established for NWSSB Detachment Concord. The range of background concentrations in urban and rural soils is presented in the text for comparison purposes only, and to show that PAHs from natural sources may contribute to levels detected at the TBB Disposal Site. No PAHs are excluded from the risk assessment based on comparison to background levels. However, the last sentence of the last paragraph of Section 7.4.3.1 will be deleted.

15. **Comment:** **Section 8.1.3.2, Surface Transport Pathways, page 8-6: The text states that**

tidal action is minimal, but that precipitation could result in movement of dissolved chemicals and sediment across the site (presumably via surface water). Aside from the inclusion of fish in Figure 8, Contaminant Exposure and Flow Diagram, the ERA does not discuss the presence of aquatic life in the inundated portions of the disposal site. The assessment endpoints do not include aquatic life other than benthic invertebrates. The lack of analytical data for surface water constitutes a data gap, and the lack of an evaluation for surface water ecological receptors should be included as a source of uncertainty in the ERA.

Response: Risk to aquatic receptors is addressed in Section 8.5, "Assessment of Risk to Benthic Invertebrates." Because benthic invertebrates have direct exposure to the sediment, it was assumed that sufficient rates of survival, growth, and reproduction to protect invertebrate populations would generally be protective of fish as well. Please see response to EPA General Comment 1.0 for surface water concerns.

16. **Comment:** **<u>Section 8.4.2.2, Spatial Variation in Exposure for Plants, Mean HQs, page 8-17, and Section 8.5.2.2, Spatial Variation in Exposure for Invertebrates, Mean HQs, page 8-27</u>: The use of a mean HQ to select COECs for plants and invertebrates is not appropriate. While this approach may be appropriate for mobile wildlife receptors, plants and invertebrates are most likely localized to areas of special physical and chemical characteristics within their habitat areas. Unless it has been verified that plants and invertebrates are uniformly distributed across their entire habitat area, the mean HQ does not provide a meaningful metric that can be used to characterize risk since it does not provide resolution of spatial variability (i.e. hot spots) on the site.**

If the Navy believes that the mean HQ is a useful way to determine which chemicals are driving risk across the site, this information may be provided as part of the risk characterization (i.e., Section 8.4.4.2, Chemicals Driving Risk to Plants, Section 8.5.4.2, Chemicals Driving Risk to Populations of Benthic Invertebrates).

Response: The mean HQ was just one of the used to evaluate risk to plants and invertebrates. By determining the COPECs for which the mean HQ exceeded 1.0, the overall magnitude of exceedance across the site was evaluated. HQs were also calculated for each location to assess how often inorganic chemicals at each sampling location exceeded a benchmark. By tabulating the number of sampling locations where the HQ exceeded 1.0, the frequency for potential toxicity and the spatial variability was also considered.

17. **Comment:** **<u>Section 8.4.2.3, Bioaccumulation, page 8-17</u>: The text incorrectly states that a bioaccumulation factor (BAF) of 1 implies that no uptake has occurred. A BAF of 1 simply indicates that the rate of chemical accumulation in the animal is equal to the rate of elimination (or that uptake has not reached**

equilibrium). Substantial uptake of a chemical may occur with a BAF of 1. For example, a non-contaminated organism exposed to 100 ppm of a chemical would have 100 ppm in its tissue at a BAF of 1. The text should be revised to correctly define the BAF.

Response: The Navy agrees that when the BAF equals one chemical uptake has occurred and that the rate of accumulation equals the rate of depuration. The definition on Page 8-17 will be revised to reflect such.

18. **Comment:** **<u>Section 8.4.2.4, Identification of Plant Chemicals of Ecological Concern, page 8-18, and Section 8.5.2.4, Identification of Benthic Invertebrate Chemicals fo Ecological Concern, page 8-29</u>: The text states that chemicals were screened out if BAFs were less than 1. This is not an appropriate procedure and is not consistent with page 8-9 (states that a qualitative evaluation of BAF would be used). BAFs are important information for determine exposure to higher trophic levels, a BAF less than one may have no relationship to toxicity to the plant or benthic invertebrate. This screening procedure should be eliminated from the ERA.**

Response: While a BAF does not itself imply either the presence or absence of toxicity, a BAF that exceeds one can nevertheless indicate a greater *potential* for toxicity. This conclusion is true for any chemical whose toxicity does not occur until a threshold tissue concentration is achieved, e.g., most metals. Hence, organisms accumulating metal concentrations that exceed those in the environment (i.e., those with BAFs greater than one) have a greater potential for exceeding the threshold metal concentration for toxicity. However, in the case of metals, a BAF exceeding one does not necessarily indicate toxicity because many aquatic organisms can render divalent metals non-toxic by sequestering the metal either to the protein metallothionein or in a calcium granule. Since the goal of a risk assessment is to prioritize those chemicals to which organisms are exposed and which may cause toxicity (i.e., rank the risk), the Navy believes using BAFs to select COECs from among numerous COPECs is both appropriate and defensible.

19. **Comment:** **<u>Section 8.5, Assessment of Risk to Benthic Invertebrates, page 8-23</u>: The text states that mean ER-Mqs will be determined, and then those values exceeding 1.5 will be used to identify locations with highest risk. The ERA should provide an explicit definition of ER-Mqs and provide an example calculation.**

Response: The mean effects range median quotient (mean ER-Mq) concept was proposed by Long and MacDonald (1998). The mean ER-Mq is the sum of the hazard quotients for all COPECs at each sampling location divided by the number of hazard quotients at that sampling location. For example, to calculate the mean ER-Mq for sampling location 309CSPWSS in Table 8-13, one sums the hazard quotients for the ten COPECS for which hazard quotients could be calculated (antimony, arsenic, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc) and divides that sum by ten, the number of COPECs with hazard quotients at the sampling location.

$$[(0.29 + 0.81 + 0.81 + 0.20 + 1.2 + 10.6 + 0.55 + 0.86 + 0.29)/10 = 3.4]$$

Long and MacDonald (1998) concluded that when the mean ER-Mq exceeded 1.5, "….[the] probability of toxicity in amphipod tests equals 74%."

Long, E.R. and D.D. MacDonald. 1998. "Recommended Uses of Empirically Derived, Sediment Quality Guidelines for Marine and Estuarine Ecosystems." *Human and Ecological Risk Assessment.* Volume 4, Number 5. Pages 1019 to 1039.

20. Comment: **<u>Section 8.5.3.3, Bioavailability, page 8-33</u>: With respect to AVS concentrations measured in sediment, the text states, "clearly, divalent metals were bound by sulfide... therefore, divalent metals were not available... to benthic invertebrates". This statement is inaccurate because metals in amphipod tissues collected from the site were measured at concentrations much higher than those in the surrounding sediment. The resulting high site-specific bioaccumulation factors (BAFs), as presented in Table 8-15, indicate that metals are available to benthic invertebrates and are being accumulated. The discussion of the AVS analysis should be limited to the results of the analysis of three sediment samples for AVS. The statement that metals were not available should be removed from the text. Additionally, the Navy should provide a discussion of all lines of evidence regarding the availability of metals, including the contradictory evidence suggested by AVS data vs. site-specific BAFs.**

Response: The apparent accumulation of cadmium, copper, lead, and zinc by amphipods does not necessarily contradict the conclusion that divalent metals were bound by acid volatile sulfide which would limit their availability for uptake by amphipods. Amphipods have the ability to synthesize the metal-bind protein metallothionein and also can sequester metals in inert calcium granules (Brown 1982). Both of these metal storage mechanisms can play two potential roles, (1) storage of scarce metals in an inert, non-toxic manner for later mobilization when additional divalent metals are needed in metabolism, and (2) sequestration in an inert manner of high concentrations of divalent metals which otherwise would be potentially toxic. Hence, it is possible for amphipods to concentrate large quantities of metals in their tissues following chronic exposure to very low, non-toxic metal concentrations in sediments, water, and their diet. In conclusion, divalent metals may be largely unavailable in sediments and yet be accumulated in high concentrations by amphipods and many other invertebrates.

Section 8.5.3.3 will be revised to address more completely the role of acid volatile sulfide, BAFs, metallothioein, and other factors in controlling metal bioavailability.

21. **Comment:** **<u>Section 8.6.1.2, Identification of Chemicals of Potential Ecological Concern, page 8-38</u>: The text refers to Table 8-20 for a list of chemicals that exceeded ambient concentrations. However, the appropriate table is Table 8-19. Please correct this discrepancy.**

Response: The correction will be made as requested.

22. **Comment:** **Section 8.6.2.2, Exposure Parameters in the Dose Model, Concentrations of Chemicals in Prey and Sediment, page 8-41, and Table 8-19, Inorganic Chemicals of Concern for the Salt Marsh Harvest Mouse: The methodology used to calculate exposure point concentrations (EPCs) is not clear. The text states that the UCL95 of the mean for the habitat area for each receptor was used to derive the EPC. However, it is not clear which samples were used for to calculate EPCs for each receptor group. For example, the footnotes to Table 8-19 state, "the dataset includes samples collected in the wetland and upland transitional habitat (includes shoreline samples)".**

The same footnote appears for Table 8-6, Inorganic Chemicals of Concern for Plants, yet the EPCs calculated for plants do not match those listed in Table 8-19 for the salt marsh harvest mouse. The report should be revised to provide a list of sample locations used to derive the EPC for each receptor group and the footnotes should be revised to accurately describe this column in the table.

Response: The UCL95 for antimony is incorrectly listed on Table 8-19; should be 14.7, not 13.6. When the UCL95 for antimony is corrected, EPCs for plants (Table 8-16) and the salt marsh harvest mouse (Table 8-19) will be the same. However, to clarify a list of sample locations used to calculate the EPC for each receptor will be provided as an appendix in the next version of the RI.

23. **Comment:** <u>Section 8.6.4.1, Risk to Aquatic Birds, page 8-53</u>: **The text states that location SB102 was not included in the risk footprint because risk was only indicated to the black-necked stilt from selenium. This subjective determination is not an acceptable procedure as part of the risk assessment. The sample location should be included in the risk footprint. Alternatively, if the Navy has judged that there is uncertainty associated with this risk estimate, further justification and/or a discussion of uncertainties associated with this particular risk estimate should be provided.**

Response: The purpose of the risk footprint was to identify areas of highest estimated risk based on all receptors assessed. Exclusion from the risk footprint does not imply "no risk."

24. **Comment:** <u>Section 8.7.2.2, Risk to Populations of Benthic Invertebrates, page 8-63</u>: **The text states that Figure 8-6 depicts HIs for each sample location; however, Figure 8-6 only depicts a footprint where HQs for each receptor group are indicated. If HIs are provided in another figure or table, please correct the text. Otherwise, please revise the text to describe the contents of Figure 8-6.**

Response: The text on page 8-63 will be changed as follows: "Specific areas of the site in which these effects may be greatest, based on HQs, are shown on Figure 8-6."

25. **Comment:** <u>Section 8.8.1, Sampling and Data Analysis, page 8-67</u>: **The report should include a discussion of the uncertainties associated with the limited information regarding the nature and extent of organic chemicals (i.e., limited data for PAHs, PCBs, and pesticides) in sediment.**

Response: Section 8.8.1 will be modified to include a discussion regarding the nature and extent of organic chemicals.

26. **Comment:** <u>Section 8.8.2, Screening Values, page 8-67</u>: **This section should include a list of chemicals that were excluded because ecological screening benchmarks were not available.**

Response: Section 8.8.2 will be modified to include a list of chemicals for which screening values were not available.

27. **Comment:** <u>Section 8.8.7, Hazard Quotients and Hazard Indices, page 8-69</u>: **This section should state that HIs were not used, and should include a discussion of the potential impacts of mixture toxicity. For example, the text could cite literature that shows whether or not metal toxicity is additive.**

Response: Section 8.8.7 will be modified to remove all reference to HIs as they were not used in the BERA.

The uncertainty associated with synergistic effects is discussed in Section 8.8.2.

28. **Comment:** **<u>Figure 8-6, Estimated Risk to Assessment Endpoints</u>: The figure depicts the "approximate risk footprint". The open circle denotes "minimal risk" to receptors. This term is not clear. The figure should refer to sample locations in which the HQ for any ecological receptor exceeds 1, and locations in which the HQ does not exceed 1. The document could further be revised to provide a series of figures depicting risk footprints for different dose calculation scenarios (e.g., typical dose/low TRV, typical dose/high TRV).**

Additionally, the risk footprint shown in this figure does not clearly depict sample locations where lead concentrations above the residential Preliminary Remediation Goal (PRG) of 400 mg/kg were detected in the soil (see page ES-6). To depict the risk footprint for the human health risk assessment, please include the 400 mg/kg lead isopleth on the figure.

Response: The purpose of Figure 8-6 was to footprint the areas of highest estimated risk based on all receptors assessed. It was not meant to imply "no risk" for areas outside the footprint.

Open circles represent locations where risk to "all" receptors was minimal. Minimal risk for each receptor was determined based on the following conditions:
<u>Plants</u> – location has less than five HQs greater than 1.0
<u>Benthic invertebrates</u> – location ER-M quotient is less than 1.5
<u>Birds</u> – sediment concentrations are less than the 95UCL for all metals.
<u>Salt marsh harvest mouse</u> – location has less than two HQ (low dose/high TRV) and HQ(high dose/high TRV) greater than 1.

The human health risk footprint will be added to Figure 8-6.

29. **Comment:** **<u>Section 9.2, Ecological Risk Assessment Conclusions, page 9-1</u>: The text states that contamination at the site exceeds "acceptable levels". Determinations regarding the acceptability of risks are not suitable as part of a Remedial Investigation. The purpose of the BERA is to characterize risks on the site so that risk managers may make decisions regarding the acceptability of risks. The text should be revised to describe the areas of the site in which risk exceeds benchmarks and areas of the site in which risk is not indicated.**

Response: The sentence stating that contamination at the site exceeds "acceptable levels" will be deleted.

30. **Comment:** <u>**Appendix A, Data Quality Objectives, page A-1**</u>**: This appendix table refers to a 250 mg/kg lead isopleth. However, the draft RI refers to a 400 mg/kg lead isopleth since the lead PRG is 400 mg/kg. For consistency, please revise the appendix table to discuss lead concentrations in excess of 400 mg/kg, not 250 mg/kg. Alternatively, please explain why Appendix A states that remediation is expected for areas where lead is present in excess of 250 mg/kg.**

In addition, the appendix table states, "the limits on error for the weight-of-evidence approach are based on professional judgment". However, the RI does not include a weight of evidence approach. Furthermore, during project meetings between the Navy and the regulatory agencies, it was decided that a weight of evidence approach would not be used. For consistency, please remove references to the weight of evidence approach from the RI.

Response: Appendix A was included as a reference to the original DQOs as presented in the quality assurance project plan [QAPP (TtEMI 2000)]. Appendix A was referenced in Section 8.3.1 to provide a which provided a discussing how DQOs were different than what was originally proposed. in Section 8.3.1, compliance with DQOs, references Appendix A explain how the DQOs were changed prior to the preparation of the RI report. Changes to the DQOs were discussed with the regulatory agencies prior to being incorporated into the RI.

31. **Comment:** <u>**Appendix G1 and Appendix H1, Dose Calculations for the Mallard and Black-Necked Stilt**</u>**: Footnote "b" states, "the dose for the 95 percent UCL was only calculated for chemicals with an HQ greater than 1". This note is not clear, since the dose for the 95 percent UCL was the only dose calculated for the ERA. Please remove the footnote or provide a clearer explanation for the derivation of the dose calculation.**

Response: Footnote b will be removed from Appendix G1 and Appendix H1.

32. **Comment:** <u>**Appendix I, Dose Calculations for the Salt Marsh Harvest Mouse**</u>**: Appendix I1 lists HQs for various combinations of TRVs and ingestion doses for the salt marsh harvest mouse. The four different TRV column headings require clarification.**

Response: Footnotes will be added to clarify the TRV column headings.

33. **Comment:** <u>**Appendix J, Applicable or Relevant and Appropriate Requirements, page J-3**</u>**: The draft RI states that chemical-specific ARARs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in establishment of numerical cleanup values. However, in Section J.2.1.1, Page J-5, text states that "No federal or state action levels have been promulgated for chemical concentrations of TPH, PAH,**

and inorganic constituents in soils or sediments." This statement is not clear since EPA PRGs are used in the Human Health Risk Assessment in this report. Please revise the RI to address this ARAR.

Response: In addition to ARARs, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) provides that other criteria to be considered (TBC) including agency advisories or guidance may be appropriate for a particular release [40 CFR Part 300.400(g)(3)]. As explained in the preamble to the NCP, TBCs should not be required as cleanup standards because they are, by definition, generally neither promulgated nor enforceable so they do not have the same status under CERCLA as do ARARs. TBCs may, however, be useful in helping to determine what is protective at a site, or how to carry out certain actions or requirements. EPA Region IX PRGs are TBCs. TBCs used in the TBB RI will be added to Table 1 in Appendix J.

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APPENDIX L

BIOACCUMULATION AND FACTORS THAT INFLUENCE THE PROCESS

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APPENDIX L

BIOACCUMULATION

1.0 Introduction

Bioaccumulation is the concentration of a chemical in plant or animal tissues taken up from (e.g., originating) from water, sediment or diet (= body burden). The total quantity of chemicals in a sediment (= bulk sediment analysis) or water sample is usually measured. Total metal does not imply that all of the metal is available to plants or aquatic animals for uptake and accumulation. Only that portion of the total sediment concentration which is in the appropriate chemical form (e.g., available) can be taken up by plants and animals. Although chemical techniques exist to assess the available form (e.g., ionic state) of a chemical, they are rarely performed because of their high cost and time-consuming nature. Availability, uptake, and accumulation are discussed in the following sections.

1.1 Definitions

Bioaccumulation describes the process through which chemicals enter plants or animals from water, soil, sediment, or air (called uptake) followed by storage in either plant or animal tissues (called accumulation). A **bioaccumulation factor** is the ratio of the animal or plant tissue chemical concentration divided by the water or sediment chemical concentration. The BAF is usually calculated using dry tissue and sediment chemical concentrations. **Bioavailability** describes whether or not a chemical is in the correct chemical form to enter the plant or animal, i.e., be taken up into plant roots or cross fish gills and enter the bloodstream.
Biomagnification describes the differing chemical body burdens present in animals at different food chain levels. Biomagnification results in animals at the higher trophic levels having chemical body burdens that are significantly greater than the chemical body burdens in animals at lower trophic levels.

1.2 Principles

A chemical must be available to enter a plant or benthic invertebrate and cause toxic effects. Availability is a function of the form in which a chemical exists; for metals form refers to ionic state and whether the metal is bound or unbound. Divalent metals such as copper and zinc dissolve in water as +2 ions. In this form they are available in the interstitial water of soils, pore water of sediments, or in lakes, streams and the ocean for uptake by plants and animals. Bound metals may or may not be available. If the uptake route is from water, metal associated with or bound to a particle is not available. If the uptake is ingestion, metal associated with or bound to a particle is available.

To move a dissolved chemical from soil or water into an organism usually requires transfer mechanisms. Such mechanisms can be passive (diffusion) or active (ATP coupled transport). The chemical enters the organism through plant roots, the cuticle on the surface of plant leaves, across the skin (dermally) of fish, across the gills of aquatic animals, or through the mouth (ingestion). In each case the chemical crosses a biological membrane covering the epidermis. When a metal-associated particle is ingested by an animals, the process is slightly different. When the metal-associated particle enters the gut, the acid present in the gut frees the metal from the particle. The metal is now a +2 ion, crosses the membrane lining the gut, and enters the bloodstream of the animal.

The magnitude of accumulation in animals depends upon the excretion rate, the tissue in which the metal is stored, and whether the animal has a biochemical mechanism (such as the protein metallothionein) to store or sequester the metal in a non-toxic mode. Since plants typically lack excretion mechanisms, accumulation magnitude in plants is determined by the tissue in which the metal is stored and whether the plant has a mechanism to store or sequester the metal in a non-toxic mode. Sometimes metal concentrations in an animal never reach steady state (when excretion and uptake are equal). In these cases if all factors remain constant, the chemical body burden increases throughout the animal's life span. However, if the animal grows (i.e., get larger and gains weight), the concentration (chemical per unit tissue) decreases. Conversely, if uptake is passive and/or excretion equals uptake, the chemical concentration in the tissues declines as the animal grows.

Rate independent accumulation occurs when metal uptake stimulates synthesis of metal-specific binding proteins such as metallothionein (Luoma 1983). Metallothionein (and other similar proteins with high cysteine content) plays a role in metal homeostasis (e.g., zinc) and in detoxifying toxic metals (e.g., cadmium) and is present in both plants and animals. These unique proteins give plants and animals the ability to render very high concentrations of normally-toxic metals harmless by sequestering the metal in a cellular matrix that makes the metal unavailable. For example, pine needles contain extremely high aluminum concentrations that are non-toxic to the tree because of the mode in which the aluminum is bound in the pine needle. Many clams can sequester metals in a non-toxic mode in a crystalline style

1.3 Assessing Bioavailability and Bioaccumulation

Measuring bioavailability in sediment or soils is difficult. The direct method would be to determine the actual chemical form; for example, is the metal a +2 ion (the available form to plants and animals) or is the metal complexed (not available to plants and animals)? Polarography and chromatography are chemical methods that can be used to determine the form in which a chemical exists in the field. However, because these direct meth ods are both costly and time-consuming, indirect methods to measure chemical availability in soils and sediments have been developed.

Indirect techniques include (1) correlating bulk chemistry with pore water chemistry, (2) analyzing chemicals in water or acid extracts from sediment or soil (such as WET-di and WET-acid extractions), and (3) analyzing other parameters such as total organic carbon, pH, redox potential, salinity, hardness, and particle grain size that influence availability.

The correlation between bulk chemistry and pore water concentration for the same chemical is generally weak so this technique is seldom used. Chemical concentrations measured in deionized water or acid soil extracts also correlate poorly with bulk chemistry measurements of the same metal in sediment or soil. This weak correlation stems from the inability in the laboratory to duplicate the time element present in the field in natural soil or sediment elution by water. Secondly, the column through which the water or acid elutes cannot be packed with soil or sediment in a manner that gives consistent reproducible results. The best indirect indicators of bioavailability are the characteristics of the soil or sediment such as grain size and total organic carbon content. As understanding of sediment chemistry grows, the ability to predict chemical availability and thus bioaccumulation increases.

Understanding of how metals dissolved in the pore water (= interstitial water) of sediments cause toxicity to benthic organisms is explained by equilibrium partitioning (DiToro, and others 1991). Metals associated with particles exist in equilibrium with metals dissolved in the sediment pore water, i.e., the metal sorbs or desorbs from/to the particle in an equilibrium process. Particle size, composition, and especially the amount and type of organic carbon in the particle play important roles in regulating this equilibrium.

Toxicity to benthic organisms does not correlate with the total metal concentration of a sediment (either on a wet or dry weight basis) (Science Advisory Board 1995; Carlson, and others 1991). Equilibrium partitioning demonstrated that availability, accumulation, and toxicity to benthic organisms correlated with the metal concentration present in the sediment pore water (Giesy and Hoke 1989). Sediment metal availability can be predicted via the sulfide concentration present in the sediment (Carlson, and others 1991; Hare, Carignan, and Herta-Diaz 1994). In anoxic sediments one mole of sulfide binds one mole of metal making the metal unavailable for uptake or accumulation. Only divalent metals such zinc, copper, cadmium, and lead, bind to sulfides. The concept does not apply to metals such as selenium and arsenic that exist in multiple valence states; while sulfide may bind some proportion of these metals in anoxic sediments, it does not necessarily bind all of the available metal. Unbound divalent metal ions dissolve in the sediment pore water, i.e., they are available. These metal ions can be taken up and/or accumulated by benthic organisms. If present in the pore water or in the organism's tissues at sufficiently high concentrations, the metals are toxic.

1.4 Factors That Affect Bioaccumulation and Uptake

The following sections briefly describe factors that affect uptke and accumulation of chemicals in plants and animals.

1.4.1 Total Organic Carbon and Grain Size

Typically chemicals such as metals adsorb to particles. As a result, factors that enhance metal adsorption to particles increase potential metal availability.

Since the number of charged binding sites increases as particle size decreases (allowing more chemical to bind to the particle), particle size plays an important role in determining availability. When a filter-feeding, benthic invertebrates eats smaller particles carrying higher quantities of chemical, the animal eats more particles to become satiated. The animal therefore accumulates more chemical. In soils or sediment, smaller particles carrying higher quantities of chemicals result in more metal per unit area of soil or sediment being potentially available to plants. If this metal dissolves in the pore water of the sediment or soil, plant uptake through the roots increases. Hence, grain size is an important variable as smaller particles carry greater contaminant loads.

Often the primary site of adsorption of chemicals to particles is the total organic carbon present in the particle. Since the concentration of total organic carbon in a particle increases as particle size decreases, smaller particles are again associated with higher chemical concentrations. As above; smaller particles therefore cause higher chemical accumulation in plants and animals.

1.4.2 pH

The hydrogen ion concentration (pH) affects metal accumulation and uptake. Metal solubility increases as pH decreases (Meyer, and others 1994). Hence, in soils or sediments with low pHs, the ratio of bound to unbound metal decreases resulting in more metal being in solution in the pore water of the sediment or soil. This increase in pore water metal concentrations means that more metal is available to the plant for uptake through its roots. Although the total metal concentration in a soil or sediment has not changed, because of greater availability at lower pHs metal uptake from the soil or sediment increases.

In lakes or streams, metals typically dissolve as +2 ions (or the equivalent hydrated form). As the pH decreases, the percentage of metals in the free ionic state increases. Thus, more metal is available for uptake across fish or invertebrate gills. As explained above, the total metal concentration is unchanged; however, the decreased pH has resulted in more metal ions being available for uptake. Since the metal ion is the toxic form, metals are generally more toxic to aquatic life in acid waters.

1.4.3 Oxidation-Reduction Potential

Oxidation-reduction potential (Eh or redox potential) measures the tendency of a system to act as an oxidizing (electron acceptor) or a reducing (electron donor) agent.

In sediments, the chemical forms of sulfur, iron, manganese, and nitrogen are determined by the redox status of the environment in which each chemical occurs. In reduced sediments iron and manganese are in the divalent, soluble state. In oxic sediments iron oxides are in a solid form called a precipitate. Metals adsorb to negatively charged sites on the surfaces of these precipitates. When reduced sediments are oxidized, hydrous iron and manganese oxides form rapidly. These soluble oxides scavenge dissolved metals (arsenic, copper, and zinc) from the water column and then precipitate, a process called coprecipitation (COE 1989). If these coprecipitates are oxidized, soluble metals are released back into the water column increasing the dissolved metal concentration (Meyer, and others 1994).

Redox processes therefore (1) determine whether a divalent metal is sorbed, precipitated,or unavailable, and (2) influence the chemical form of chemicals such as arsenic and selenium. Unlike zinc and copper that exist in water or sediment in a single ionic form (+2 ion), arsenic and selenium occur in water, sediments, and soil in multiple valence states. Somearsenic and selenium valence states are available for uptake to animals and plants; others are not

1.4.4 Hardness

Hardness describes the concentration of multivalent cations, particularly calcium and magnesium in freshwater. There is no equivalent concept for seawater or for soils or sediments. Divalent cations (Ca^{2+} and Mg^{2+}) cause particulate, colloidal, or soluble organic matter in the water column to flocculate and settle; trace metals may coprecipitate with this flocculated material (COE 1989). Calcium and magnesium cations generally do not affect speciation of cationic toxicants, but may compete for binding sites on the same ligands. Hardness does not affect speciation of anionic toxicants (Erickson, and others 1994).

Most metals are less toxic to aquatic organisms in hard water (Meyer, and others 1994). The specific chemical mechanism that causes this reduction in toxicity is not well understood although it is generally attributed to the competition between calcium, magnesium, and metal ions to cross the gill membranes on the gill lamallae.

1.4.5 Salinity

Salinity is a measure of the percent salt dissolved in seawater and usually is reported in parts per thousand units. Salinity modifies chemical availability by through its influence of metal particle binding. Availability of metals that do not bind strongly to particles in seawater (such as zinc and copper) is not strongly influenced by salinity. However, metals that bind strongly to particles in seawater (such as cadmium) are strongly influenced by salinity. Cadmium is more toxic to freshwater organisms because in freshwater it is unbound, occurring primarily as a +2 ion . In seawater cadmium binds strongly to particulates, reducing the availability of cadmium to non-filter feeding aquatic organisms. As a result, bivalves accumulate more cadmium as salinity decreases (Hawker 1990). Bioavailability of metals in estuarine habitats varies widely caused by rapid freshwater/seawater transitions.

1.4.6 Biologically-Mediated Transformation

Many organometallic compounds form through biologically-mediated processes. For example, microorganisms alkylate lead and mercury, and phytoplankton synthesize organic forms of arsenic which are biomagnified (Hawker 1990). Biomethylation increases the availability and toxicity of arsenic, selenium, and mercury by making the metal more lipid-soluble which makes passage across biological membranes easier (Meyer, and others 1994). Increasing the number of organic substitutions on a metallic compound makes the compound more hydrophobic and therefore more likely to bioaccumulate (Hawker 1990).

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APPENDIX M

SAMPLE LOCATION RECEPTOR TABLE

APPENDIX M
SAMPLE LOCATIONS USED IN EXPOSURE POINT CONCENTRATIONS FOR ASSESSMENT ENDPOINT RECEPTORS

Sample Location	Invertebrates (Aquatic Habitat)	Plants (Wetland & Upland Transitional Habitat)	Mallard (Aquatic and Wetland & Upland Transitional Habitat)	Black-Necked Stilt (Aquatic and Wetland & Upland Transitional Habitat)	Salt-Marsh Harvest Mouse (Wetland & Upland Transitional Habitat)
309SSCS	✓		✓	✓	
309SSNS	✓		✓	✓	
309SSSS	✓		✓	✓	
309SB05	✓	✓	✓	✓	✓
309SB106	✓	✓	✓	✓	✓
309CSPWSS	✓	✓	✓	✓	✓
SB001		✓	✓	✓	✓
SB002		✓	✓	✓	✓
SB003		✓	✓	✓	✓
SB004		✓	✓	✓	✓
SB005		✓	✓	✓	✓
SB006		✓	✓	✓	✓
SB007		✓	✓	✓	✓
SB008		✓	✓	✓	✓
SB009		✓	✓	✓	✓
SB010		✓	✓	✓	✓
SB011		✓	✓	✓	✓
SB012		✓	✓	✓	✓
SB013	✓	✓	✓	✓	✓
SB014	✓	✓	✓	✓	✓
SB015	✓	✓	✓	✓	✓
SB016	✓	✓	✓	✓	✓
SB017		✓	✓	✓	✓
SB018	✓	✓	✓	✓	✓
SB019	✓	✓	✓	✓	✓
SB020	✓	✓	✓	✓	✓
SB100	✓		✓	✓	
SB101	✓		✓	✓	
SB102	✓		✓	✓	
SB103	✓		✓	✓	
SB104	✓		✓	✓	
SB105	✓	✓	✓	✓	✓
SB106	✓		✓	✓	

APPENDIX M
SAMPLE LOCATIONS USED IN EXPOSURE POINT CONCENTRATIONS FOR ASSESSMENT ENDPOINT RECEPTORS

Sample Location	Invertebrates (Aquatic Habitat)	Plants (Wetland & Upland Transitional Habitat)	Mallard (Aquatic and Wetland & Upland Transitional Habitat)	Black-Necked Stilt (Aquatic and Wetland & Upland Transitional Habitat)	Salt-Marsh Harvest Mouse (Wetland & Upland Transitional Habitat)
SS200	✓		✓	✓	
SS201	✓		✓	✓	
SS202	✓		✓	✓	
SS203	✓		✓	✓	
SS204	✓		✓	✓	
SS205	✓		✓	✓	
SS206		✓	✓	✓	✓
SS207	✓		✓	✓	
SS208	✓		✓	✓	
SS209	✓		✓	✓	
SS210		✓	✓	✓	✓
SS211		✓	✓	✓	✓
SS212		✓	✓	✓	✓
SS213		✓	✓	✓	✓
SS214		✓	✓	✓	✓

APPENDIX N

REGIONAL WATER QUALITY CONTROL BOARD DATA

REGIONAL WATER QUALITY CONTROL BOARD
SURFACE WATER SAMPLE RESULTS FOR TBB DISPOSAL SITE

TOTAL METALS									
Analyte	**Freshwater CCC based on hardness = 400 mg CaCO3***	**Laboratory Reporting Limit**	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Site 5**	**Site 6**	**Site 7**
Silver	44.05	7	ND	ND	ND	ND	ND	ND	ND
Arsenic	150.00	100	ND	ND	ND	ND	ND	ND	ND
Cadmium	21.58	10	ND	ND	ND	ND	ND	ND	ND
Chromium	5404.62	10	ND	ND	ND	ND	ND	ND	71
Copper	51.68	10	ND	ND	ND	ND	ND	ND	ND
Mercury	na	0.2	ND	ND	ND	ND	ND	ND	ND
Nickel	1515.92	30	ND	ND	ND	ND	ND	ND	ND
Lead	476.82	75	ND	ND	ND	ND	ND	ND	ND
Selenium	na	100	ND	ND	ND	ND	ND	ND	ND
Zinc	387.83	20	ND	ND	ND	ND	ND	ND	ND
DISSOLVED METALS (UG/L)									
Analyte	**Freshwater CCC based on hardness = 400 mg CaCO3***	**Laboratory Reporting Limit**	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Site 5**	**Site 6**	**Site 7**
Silver	37.44	7	ND	ND	ND	ND	ND	ND	ND
Arsenic	340.00	100	ND	ND	ND	ND	ND	ND	ND
Cadmium	19.12	10	ND	ND	ND	ND	ND	ND	ND
Chromium	1707.86	10	ND	ND	ND	ND	ND	ND	ND
Copper	49.62	10	ND	ND	ND	ND	ND	ND	ND
Mercury	na	0.2	ND	ND	ND	ND	ND	ND	ND
Nickel	1512.89	30	ND	ND	ND	ND	ND	ND	ND
Lead	280.85	75	ND	ND	ND	ND	ND	ND	ND
Selenium	na	100	ND	ND	ND	ND	ND	ND	ND
Zinc	379.30	20	ND	20	20	26	21	26	ND

* EPA State of California Water Quality Criteria (California Toxics Rule)
Criterion is hardness dependent. This value corresponds to a total hardness of 400 mg/L as CaCO3 in the water body.
Units are in micrograms per liter
ND - Non detect

REGIONAL WATER QUALITY CONTROL BOARD
SEDIMENT SAMPLE RESULTS FOR TBB DISPOSAL SITE

Analyte	Tidal Area Ambient (mg/kg)[a]	SF Bay Ambient (mg/kg)[b]	ER-L (mg/kg)[c]	ER-M (mg/kg)[c]	Reporting Limit (mg/kg)	Site 1	Site 2	Site 3	Site 4
Silver	NA	0.58	1.00	3.70	0.59	ND	ND	ND	ND
Arsenic	27.00	15.30	8.20	70.00	8.5	ND	ND	ND	120
Cadmium	1.90	0.33	1.20	9.60	0.85	ND	ND	ND	ND
Chromium	82.10	112.00	81.00	370.00	0.85	2.4	1.9	4	15
Copper	81.00	68.10	34.00	270.00	0.85	4.7	3.7	9.4	**97**
Mercury	0.32	0.43	0.15	0.71	0.019	ND	ND	0.019	0.04
Nickel	120.00	112.00	20.90	51.60	2.5	3.5	2.5	4	18
Lead	95.00	43.20	46.70	218.00	6.4	6.5	ND	17	**490**
Selenium	NA	0.58	1.00	3.70	8.5	ND	ND	ND	ND
Zinc	264.00	158.00	150.00	410.00	1.7	10	7.7	18	87

Notes:
ER-L - Effects range-low (Long and others 1995).
ER-M - Effects range-median (Long and others 1995).
mg/kg - Milligrams per kilogram.
ND - Nondetect
SF- San Francisco.

[a] PRC Environmental Management, Inc. 1996. "Technical Memorandum, Ambient Metal Concentrations in the Tidal Area Soils."

[b] RWQCB. 1998. "Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May.

[c] Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management.

Taylor Bridge Boulevard Sampling Sites Map
SFBRWQCB 12717.01.

Site Name